America's Private Land

A Geography of Hope

United States
Department of
Agriculture

Natural
Resources
Conservation
Service

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FOREWORD

Author and historian Wallace Stegner once wrote that the preservation of our Nation's last tracts of wildlands represented a "geography of hope." Stegner was right, and thanks to him and others who pressed for passage of the Wilderness Act of 1964, we can enjoy a national system of wildlands. Yet today we understand that narrowly circumscribed areas of natural beauty and protected land alone cannot provide the quality of environment that people need and want. We must also recognize the needs of America's private land and private landowners for us to truly have a geography of *hope*...

...*hope* that we can build economically and environmentally sustainable communities for ourselves and for our children,

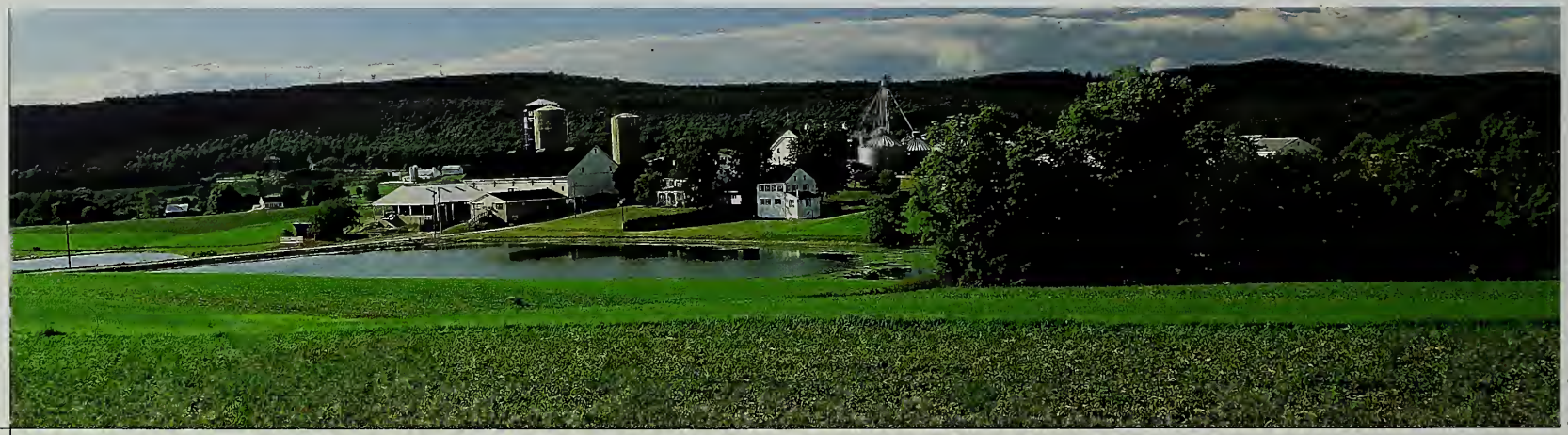
...*hope* that we and our children and their children will retain the opportunity to renew ourselves and our spirits among that which remains wild and free, and

...*hope* for so much of the life with which we share this Earth.

As we approach the next millennium, we must rededicate our efforts to conserve the land. We still live in a beautiful, largely natural world, but that world is increasingly characterized by accelerated change. World population growth and our urge to live richly are exerting unprecedented pressures on our soil, air, water, and other natural resources. Without intending to do so, we continue to push nonhuman life into ever-smaller places. Today, we run the risk of those places eventually becoming mere islands on a domesticated landscape.

If Stegner were with us today, he likely would agree: A land comprised of wilderness islands at one extreme and urban islands at the other, with vast food and fiber factories in between, does not constitute a geography of hope. But private land need not be devoted to a single-purpose enterprise. With a broader understanding of land and our place within the landscape, our Nation's farms, ranches, and private forest land can and do serve the multiple functions that we and all other life depend upon.

The farm on which my wife, my children, and I have lived and worked for the past 23 years is one example of how private land can function. We are but one of the 2 million farms and ranches that comprise much of the private land in America.



Larry Lefever / Grant Heilman Photography

We produce traditional commodities for the marketplace: corn, soybeans, oats, hay, milk, beef, mutton and wool, Christmas trees, and hardwood sawlogs. Elsewhere across the country, the crops vary, but the concept does not. Commodities for the marketplace are what our Nation's farms, ranches, and other private enterprises are about.

But private land is about much more than this. The foundation of our farm's productivity is our soil, a complex, living system that, although largely unrecognized as important in our national environmental policies, is in fact the basis of all life. If we farm our soil well, its productivity will be sustained by recycling what was once living into new life.

Soil on our farm harbors a host of microorganisms that perform an array of functions that sustain life. Soil also buffers the multitude of foreign substances our industrial society releases into our environment. If we farm well, healthy soil will help to process those wastes, although agricultural land alone cannot possibly offset the need for less-polluting urban and industrial activities.

Most water that we use falls first on our Nation's farms and ranches, where it is partitioned by soil into surface water, groundwater, and vapor that reenters the atmosphere through plants. If we manage our soil well, water will be used efficiently. By the time it leaves our farm, heading downstream to support our urban neighbors and other life, it will be clean.

Soil on our farm is also a critical component of the carbon cycle. In this era of accelerated fossil fuel use, our soil, if farmed well, can sequester carbon, thus helping to stabilize global climate.

Our farm, like all private land, is not only our home place but the home place of many plants and animals that inhabit this Earth with us. They are a part of creation and thus deserve our respect. If we farm well, we can continue to coexist with this rich array of life. Wilderness sanctuaries need not be the only home place for "noneconomic" species. Every farm and ranch and private woodlot in our Nation can and should be home to abundant wild life.

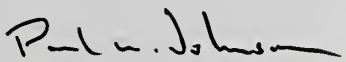
Our farm, our neighbors' farms, and all other private land comprise a majority of the American landscape. As we use our land, we paint our individual and community portraits on the land. Done well, those portraits can be a source of pride.

The story that follows is our attempt to present to you the state of America's private, nonurban land, but it is intended to be more than a national report card. We hope it prompts you to think about land in a different way.

Private land in America produces abundant food and fiber. It does much more, however. Private land represents many rich, diverse places, full of life. Those places, when healthy, function in ways essential to the sustenance of all creatures on this Earth, including humankind.

It should become obvious in reading this story that healthy, productive land does not simply happen. A good deal of thought, work, and conservation assistance–both technical and financial–are often requisite to success.

America's farmers, ranchers, and woodlot owners work hard to produce multiple benefits from the land. If our Nation and those landowners are willing to partner together, we in the Natural Resources Conservation Service believe that America's private land, along with public land, can become our Nation's real geography of hope.



Paul W. Johnson, Chief

Introduction

Grant Heilman Photography

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America's Private Land, A Geography of Hope is a call to action—a call to renew our national commitment to America's private land and private landowners. In 1935, this Nation made an historic commitment to the stewardship of private land in the Soil Conservation Act. That Act, passed in the depths of the Dust Bowl, recognized that the long-term welfare of all Americans rested in the hands of farmers and ranchers struggling to keep their land from eroding away.

At that time, many of us were tied to the land, as farmers, ranchers, or in the local businesses and industries that supported those working the land. Most citizens understood and identified with life on the land and in rural America. Their stake in the welfare of the land and those who worked the land was clear.

As we approach the end of this century, our relationship to the land has changed. Few people now live or work on farms and ranches. Far more live in cities and suburbs. Many of us have lost what author Wallace Stegner called our "sense of place"–that intangible bond between ourselves and the natural world around us.

What happens on the land, however, remains crucial to our economic and environmental well-being, even if we never set foot on a farm or ranch. Our connection to the land is there every time we buy a loaf of bread, or turn on the tap for a cool drink of water, or admire a flock of geese heading south in the fall. Many of us may have lost our sense of place, but none of us has lost our dependence on place.

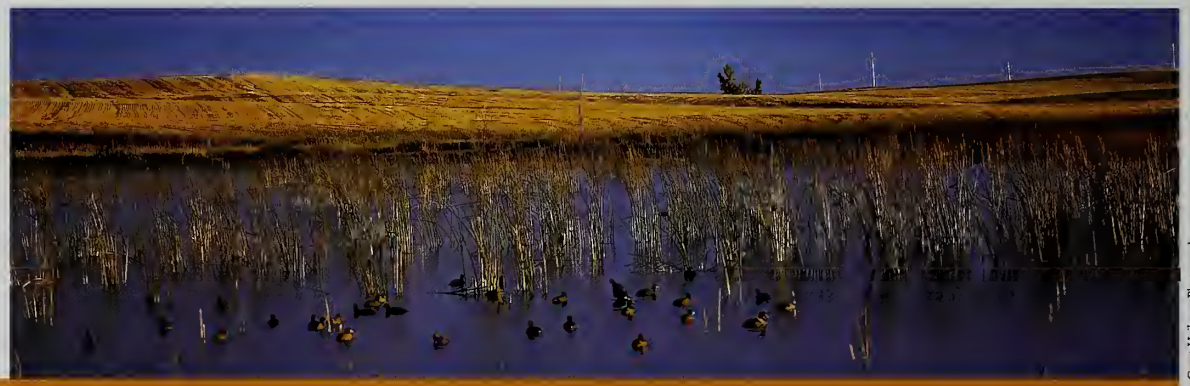
What the Land Produces

We may have become an urban nation, but we remain an agricultural land. Nearly 70 percent of the United States, exclusive of Alaska, is held in private ownership by millions of individuals. Fifty percent of the United States, 907 million acres, is cropland, pastureland, and rangeland owned and managed by farmers and ranchers and their families. The responsibility for stewardship of this land lies in the hands of about 4.7 million individuals. This means that the care of 50 percent of the United States is in the hands of less than 2 percent of our citizens.

We rely on these fellow citizens and neighbors to produce the food and fiber we need. And they are exceedingly good at doing so. Today, each acre of cropland produces nearly 3 times what was produced on the same acre in 1935. This dramatic productivity increase has made food prices lower for Americans than they are for citizens of any other industrial country. Exports of agricultural commodities reached $56 billion in 1995, 7 percent of our export total that year.

Through their care and stewardship of the land, farmers and ranchers produce safe drinking water, clear-flowing streams, lakes full of fish, skies full of ducks and geese, and scenic landscapes.

But farmers and ranchers produce much more than food and fiber. Through their care and stewardship of the land, farmers and ranchers produce safe drinking water, clear-flowing streams, lakes full of fish, skies full of ducks and geese, and scenic landscapes. We do not buy these commodities in our supermarkets, and their prices are not listed on the Chicago Board of Trade, but we value them just the same.



Grant Heilman Photography

From a national perspective, then, our land will be healthy not because of broad public policies and programs but because each landowner will make his or her own individual place healthy.

It is hard to overestimate the importance of farms and ranches in producing these nonmarket environmental goods and services. Nesting success for North American waterfowl has increased by at least a third since 1985, due in large part to farmer and rancher participation in the Conservation Reserve Program. Nearly 88 percent of the water that falls on the United States as rain and snow each year falls on private land before it reaches our lakes and streams and groundwater aquifers. Public awareness of the importance of these environmental amenities is increasing. Today, most Americans support policies and programs to help private landowners conserve natural resources and produce traditional as well as nontraditional products of the land.

The National Commitment To Conservation on Private Land

Early in this century, at the urging of President Theodore Roosevelt and conservationists John Muir and Gifford Pinchot, we had the foresight to set aside America's special places–national parks and forests and, later, wildlife refuges, grasslands, seashores, and wilderness areas. America's public land became a showcase for some of the most dramatic and beautiful landscapes on the North American continent.

But there were others who recognized the importance of America's private land to the health of our Nation. Hugh Hammond Bennett argued that the health of private land required a national commitment to sharing the cost of caring for that land. It took the devastation of the Dust Bowl for his mes-

sage to be accepted. The Soil Conservation Service, predecessor to the Natural Resources Conservation Service, was created in 1935 to help farmers and ranchers care for the land. The Soil Conservation Act of 1935 charged SCS to deliver conservation assistance to farmers, ranchers, and other private landowners.

The national commitment to private land stewardship was then and remains very different than the commitment to the care of public land. Unlike the health of public land, which is the responsibility of a handful of Federal agencies, the health of private land rests in the hands of millions of individuals, most of whom are inclined to do the right thing. The knowledge, creativity, skill, and commitment to conservation of each landowner thus determines whether most of America's land is healthy. From a national perspective, then, our land will be healthy not because of broad public policies and programs but because each landowner will make his or her own individual place healthy.

A Conservation Success Story: The Driftless Area of the Upper Midwest

The first public forum for the Soil Erosion Service (which became the Soil Conservation Service, then the Natural Resources Conservation Service) was a demonstration project in Coon Valley, Wisconsin. Established in 1933, the project helped local farmers plan conservation measures for their land. SES offered each farmer assistance to install a reorganized system of land use that would conserve soil and thus agriculture, but these systems would also integrate forestry, game, fish, fur, flood-control, scenery, songbirds, and any other pertinent interest.

A 1992 study by SCS concluded that soil erosion on cropland in the area known as the Driftless Area of the upper Mississippi Valley, including Coon Valley, had been nearly 15 tons per acre annually before the demonstration project was established. By 1992, the average annual erosion rate had declined to just over 6 tons per acre. This occurred even though the acreage in row crops–that land expected to have high erosion rates–had nearly doubled, and the acreage in small grains–normally having lower erosion rates–had declined more than 80 percent. Today, Coon Valley remains a productive agricultural area as a result of the conservation effort initiated more than 60 years ago.

The reasons? Installation of traditional conservation practices, such as stripcropping, contouring, and terracing; a recent surge in the use of no-till and other crop residue management technologies; and enrollment of more than 400,000 acres in the Conservation Reserve Program. Equally important was establishment, by the early 1940s, of local soil conservation districts in the Driftless Area to bring a permanent, local voice to natural resource decisions.

From the perspective of 60 years, we can see how natural resource conservation has helped this area thrive through changing times. The experience in the Driftless Area reinforces the idea that conservation is a continuing responsibility that produces continuing rewards, particularly when multiple interests can act jointly.

Stripcropping, terraces, and management of small woodlots were among the conservation practices applied by the late 1940s throughout much of the Coon Valley demonstration project area.

Time for Renewal

The conservation pioneers of the 1930s did much more than create a Federal agency. They also put in place a remarkable Federal, state, and local governmental partnership for delivering conservation assistance to farmers and ranchers. The Federal Government, Hugh Bennett and others concluded, could best deliver technical and financial assistance for conservation, while state governments and local conservation districts could more effectively connect with individual landowners and set local priorities for action. That partnership remains a model for intergovernmental cooperation today.

Conservation Districts: The Local Conscience of Conservation

From the outset of Federal involvement in soil and water conservation, national leaders recognized that something was missing: more–and more formal–local involvement and support. The 1935 law that created the Soil Conservation Service foresaw this need and authorized the new agency "to cooperate and enter into agreements with, or to furnish financial or other aid to, any agency, governmental or otherwise...."

Using this authority, U.S. Department of Agriculture officials drafted a Standard State Soil Conservation Districts law, which President Franklin D. Roosevelt sent to state governors in February 1937. Roosevelt urged the states to pass laws based on this model, stating that "to supplement the Federal programs, and safeguard their results, state legislation is needed." In this new twist on federalism, USDA could sign a memorandum of understanding directly with the local conservation districts thus created.

Later that same year, the North Carolina State Conservation Commission was formed, as was the Nation's first conservation district in Anson County, Hugh Hammond Bennett's home county. The conservation district movement spread rapidly. Within a few years, more than half of the Nation had been organized into districts, and today, districts–variously known as soil conservation districts, soil and water conservation districts, natural resource conservation districts, and land conservation committees–are organized through local elections throughout the United States; they now cover nearly all of the Nation's privately owned land.

From the beginning conservation districts adopted a cooperative approach, drawing on many sources for technical knowledge, financial assistance, and broad-based educational programs for natural resources conservation and management. Districts serve as a bridge between Federal, state, and local resource management agencies and local land managers, performing a variety of functions and activities in coordinating and implementing state and national programs. Many districts also use their own technical and other capabilities in assisting land managers with natural resource management problems.

Over the past 60 years, conservation districts, state conservation agencies, and NRCS have forged what is widely recognized as a unique and effective partnership. Both by legislation and by agreement between USDA and states, NRCS provides technical services to land users through conservation districts. Each conservation district in the Nation has signed a memorandum of understanding with the Secretary of Agriculture, but also a supplemental agreement with NRCS that sets forth the basis for working together cooperatively.

Now, six decades later, that conservation partnership faces new and more complex challenges. Despite significant gains by America's farmers and ranchers, particularly over the past decade, soil erosion continues to threaten the productive capacity on nearly 1 of every 3 cropland acres. But new problems are becoming apparent as well, as is the interrelated nature of these problems. Water quality and supply problems confront many communities, and we have grown more concerned about the loss of wildlife habitat and the conservation of biodiversity. The Nation needs to make a firm commitment to share the burden of caring for private land, even more so now than in the 1930s.

But the public financial commitment to conservation assistance has diminished measurably since the 1930s. In 1937, Congress appropriated $440 million in financial assistance through a new Agricultural Conservation Program and $23 million in technical assistance through SCS for conservation. Federal financial assistance was based on the premise that the broader public interest was served by sharing the cost of caring for private land. Technical assistance–helping landowners understand their land and the tools available to manage their land–was just as important as financial assistance to ensure that conservation practices were effective and workable for the landowner.

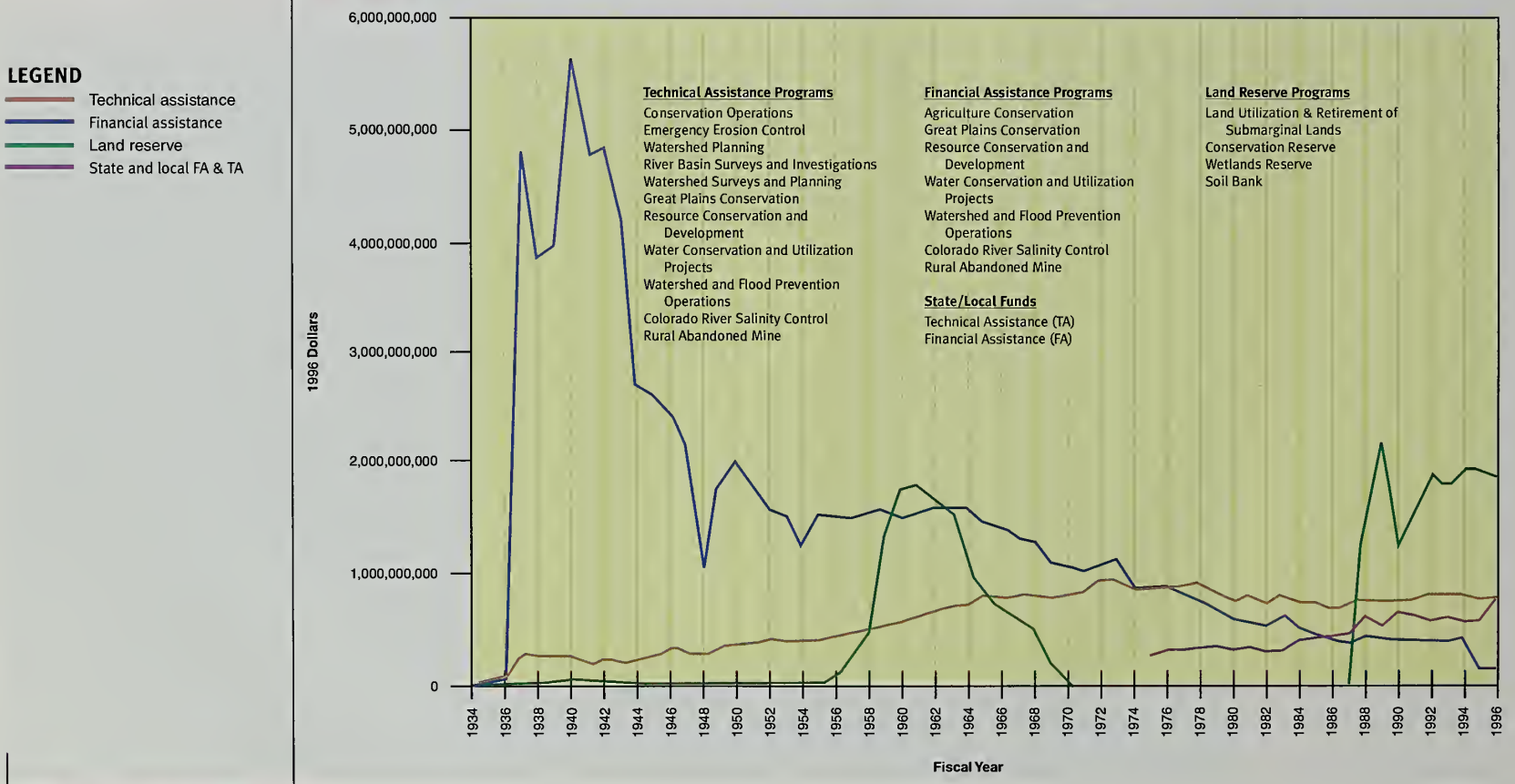
Today, the public financial commitment for conservation on private land is well below the 1937 level. We would spend $4.8 billion (in 1996 dollars) to share the cost of conservation today if we were to match the 1937 spending level. Instead, projected spending for conservation assistance on private land each year over the 7 years covered by the 1996 farm bill amounts to

NRCS conservationists help landowners plan and apply effective, profitable conservation measures, including conservation tillage, which reduces soil erosion and increases soil moisture.

about $2.2 billion, less than half the annual commitment made 60 years ago. Funding for technical assistance has grown since 1937, but even that has declined over the past two decades.

Private land constitutes the single largest portion of our country's landscape. A majority of the Federal commitment to conservation on private land today is accomplished through the U.S. Department of Agriculture, with annual appropriations of less than $2 per acre. In contrast, the commitment to protecting and managing public land is the responsibility of a number of agencies, and annual appropriations approach $10 per acre.

MAJOR U.S. DEPARTMENT OF AGRICULTURE, STATE, AND LOCAL CONSERVATION PROGRAMS, 1934-1996
APPROPRIATIONS FOR TECHNICAL ASSISTANCE, FINANCIAL ASSISTANCE, AND LAND RESERVE
1996 Constant Dollars



State and local governments, including conservation districts, have added financial and staff resources to the conservation effort on private land in the last 20 years, but even with those contributions, the total falls well short of the need.

...it is time to regain our sense of place and renew our commitment to private land and private landowners.

That shortfall is frustrating to conservationists–farmers, ranchers, the professionals who serve them, and the public that supports them–who see land abused where it need not be; who see water polluted and watersheds damaged in ways that cost less to prevent than to rectify; who see landscapes that people prize lost–some permanently–for lack of simple care.

Compounding that frustration is the fact that we have tools and technologies today that the conservation pioneers could only have dreamed of in 1937. Conservation tools that keep the soil covered even after tillage and new tools that dramatically increase the efficiency with which fertilizers, pesticides, and irrigation water are applied are making conservation pay off for landowners and the public. Innovative approaches to using plants as engineering tools–working with the land through installation of grassed waterways, riparian buffers, and restoration of stream channels–open up a world of new possibilities to fit conservation onto the landscape and into the bottomlines of farmers and ranchers.

A Call to Action

Our 60-year-old Federal, state, and local conservation partnership remains strong, and the opportunities to work with new partners grows every day. Already there are hundreds of communities trying to work together in one way or another to protect their natural resources. Moreover, public support for conservation and the environment is growing.

A 1995 Gallup poll revealed that a majority of citizens supported Federal incentive and assistance programs to conserve natural resources, and a majority of those citizens believed that funding for these activities should remain stable or increase. An NRCS survey of public attitudes toward agriculture and the environment revealed similar opinions. About half of those surveyed believed that society should, at a minimum, share conservation costs equally with landowners. Roughly one-third believed that society should be responsible for the greater share of conservation costs. The survey also showed a substantial preference for increased flexibility and authority for conservation districts and NRCS field staff in developing and implementing conservation solutions based on local conditions.

Clearly, it is time to regain our sense of place and renew our national commitment to private land and private landowners. As we contemplate our challenges in caring for the land, we cannot afford to tell landowners that stewardship is their concern alone. Just as in the Dust Bowl days, we are all in this together, and each of us must respond. The task is enormous and complex. It challenges millions of landowners, thousands of scientifically trained public employees, hundreds of public agencies, and a host of legislators and other public leaders. The task is not impossible, however, if we share a common vision and answer the call to action with a commitment to the future. America's private land will then become a truly integral part of our Nation's geography of hope.

Thinking About Land and People

PhotoDisc

In a very real sense the land does not lie;
it bears a record of what men write on it.
In a larger sense a nation writes its record on the land.

— W.C. Lowdermilk
Assistant Chief
Soil Conservation Service, 1953

PhotoDisc

PhotoDisc

Every day, people write their record on the land and read the record left by others. We shape the land, and the land shapes us.

Aldo Leopold talked about this relationship in terms of "reading" the land. "Once you learn to read the land," Leopold wrote, "I have no fear of what you will do to it, or with it. And I know many pleasant things it will do to you."

Reading the land accurately is no simple task. Land–soil, water, air, plants, and animals–is a marvelously complex and dynamic system that often changes in ways too subtle to perceive. Through the ages, people solved this challenge by observing land over long periods of time. Generation after generation lived on the same land, applied similar technologies to it, and constructed a history to guide each new generation.

In spending a long time in one place, people developed an intimate understanding of that place. They adapted to its needs and demands while working to shape the land in a way that would sustain them in the future.

Today, we have greatly enlarged the scale of the landscape with which we interact. Agricultural producers manage larger units, which often adds to the variety and complexity of their task. People travel greater distances more frequently. Even when they stay at home, they experience and affect a larger share of the world through electronic communications and economic activities.

The pace of change in our society has accelerated as well. New technologies continuously come on line. Now, instead of spending generations focused on one place and using it in essentially one way, we find ourselves moving from place to place, needing to use new and different tools. Many of those places are unfamiliar, as are the tools.

"Back home" to many Americans is a place they left behind, not where they spend their working days. Obtaining adequate food, water, and shelter for themselves and their families is no longer the challenge of understanding and relating to the land around them. It is instead the challenge of achieving economic success in a world of walls, windows, and the World Wide Web.

With life so greatly changed and daily activities so far removed from any intimate contact with the land, many people today still seek assurance that the bond between themselves and the land that supports them remains intact. A sustainable society requires a sustainable environment. One depends upon the other. We are thus challenged to think about the land in new ways and to communicate what we see to people whose

Larry Lefever / Grant Heilman Photography

Land—soil, water, air, plants, and animals—is a marvelously complex and dynamic system that often changes in ways too subtle to perceive.

connections to the land are less direct but just as essential. In a world awash in data, statistics, and sound bites, we seek new insight and meaning.

On behalf of the American people, some of whom work the land but most of whom spend their time far removed from the land, NRCS undertakes the challenge of reading the land and reporting on its status, condition, and trends. The agency takes advantage of a wide array of modern, sophisticated tools. The beautiful views of the Earth captured by astronauts from space are replicated millions of times by earth-orbiting satellites, and science allows us to learn more and more from those and other electronic images.

Back on Earth, NRCS scientists sample soils and evaluate soil quality, work with watershed information and water quality reports, and record changes in land use patterns. Studies by public and private institutions alike are brought together to help paint a picture of the American land. We thus meet the challenge of understanding the world around us in the face of mobile societies, large landscapes, exploding technological change, and growing population pressures by working cooperatively, harnessing science and technology, and expanding our awareness and knowledge together.

An Ecological View of the Land

Today, we have available many indicators of land health. One of the most basic and perhaps least understood is soil quality. Soil supports plant growth and represents the living reservoir that buffers the flows of water, nutrients, and energy through an ecosystem. Most water that people see and use falls first on the land. It then either percolates to the groundwater, runs over the land surface to a stream or lake, or moves laterally through the soil to a surface water body. Whichever the route, the quality of

Watersheds: Areas for Conservation

When water falls on land, during a rainstorm, for example, it flows downhill into drains, ditches, streams, rivers, and other surface water bodies or percolates through the soil to aquifers or other underground waters. All of the land from which water flows into a particular water body is known as that waterway's watershed. Complex natural landscapes and their environmental functions are often best understood when thought of in terms of watersheds.

Watersheds tend to be composed of multiple ecosystems (forests, grassland, wetlands, etc.) and ecotones (transition zones, such as riparian areas) that are linked by the movement of energy, nutrients, and water through various pathways (groundwater recharge zones, rivers, streams, soil infiltration, etc.). How these pathways function is critical to the health of all the linked systems. Because of these relationships, the watershed becomes a useful area for conservation activities. But in defining an area of conservation interest to be a watershed, one must still recognize that the dynamics of a single watershed are at least in part conditioned by activities surrounding it.

The United States is divided into 18 major drainage areas, 160 principal river basins, and some 2,200 small watersheds, which average 900,000 acres in size. Drainage basins can be quite large (for example, the Chesapeake Bay drainage basin extends from central New York to central Virginia), which makes them inappropriate for local conservation planning and management purposes. But drainage basins can be an appropriate scale for the application of national or regional natural resource management goals that might complement or coordinate local action.

the soil largely determines the water's chemical and biological characteristics and flow dynamics.

Soil quality refers to the capacity of a soil to perform these beneficial functions. A soil's quality is determined by its texture, structure, water-holding capacity, porosity, organic matter content, and depth, among other properties. Because soils naturally vary in their capacity to perform these functions, we must tie our understanding of soil quality to landscapes and land use. A soil with sufficient capacity to support one ecosystem–rangeland, for example–may not be capable of supporting a corn field.

If we are to read the land accurately, we must understand soil quality for two important reasons. First, we must match our use and management of land to soil capability. Improper use of a soil can lead to disappointment and failure, as well as damage to the soil and ecosystem. Second, we must establish baseline understanding about soil quality so we can recognize ongoing trends. If soil quality is stable or improving, we have a good indicator that the ecosystem is sustainable. If soil quality is deteriorating, the larger ecosystem will almost certainly decline with it.

If soil and water are healthy, the ecosystem has an opportunity to remain healthy. If soil and water are unhealthy or deteriorating in quality, the system is probably unsustainable.

The Know Your Watershed campaign is a national partnership of 50 corporations, conservation groups, commodity growers associations, and Federal agencies, coordinated by the Conservation Technology Information Center. The campaign was formed to encourage formation of 500 locally initiated watershed partnerships by the year 2000. Among its educational products is a video explaining what a watershed is and what the benefits of local partnerships are in achieving community environmental goals within watersheds.

Watershed Campaign Map

The Know Your Watershed campaign has identified and profiled nearly 700 existing watershed partnerships across the United States. This map shows the distribution of about two-thirds of these partnerships.

Source:
Conservation Technology Information Center, Know Your Watershed Campaign, 1996

We must also understand watersheds, which provide a scale that often proves useful in identifying important landscape relationships. Water is the lifeblood of natural systems, and the quantity and quality of water, both surface water and groundwater, provide useful measures of how well those systems are functioning. Where streams and rivers flow clear and clean, the soils, plant and animal communities, and human elements of the system are likely healthy as well.

To read the land accurately, therefore, requires an assessment of soil quality and watershed health. If soil and water are

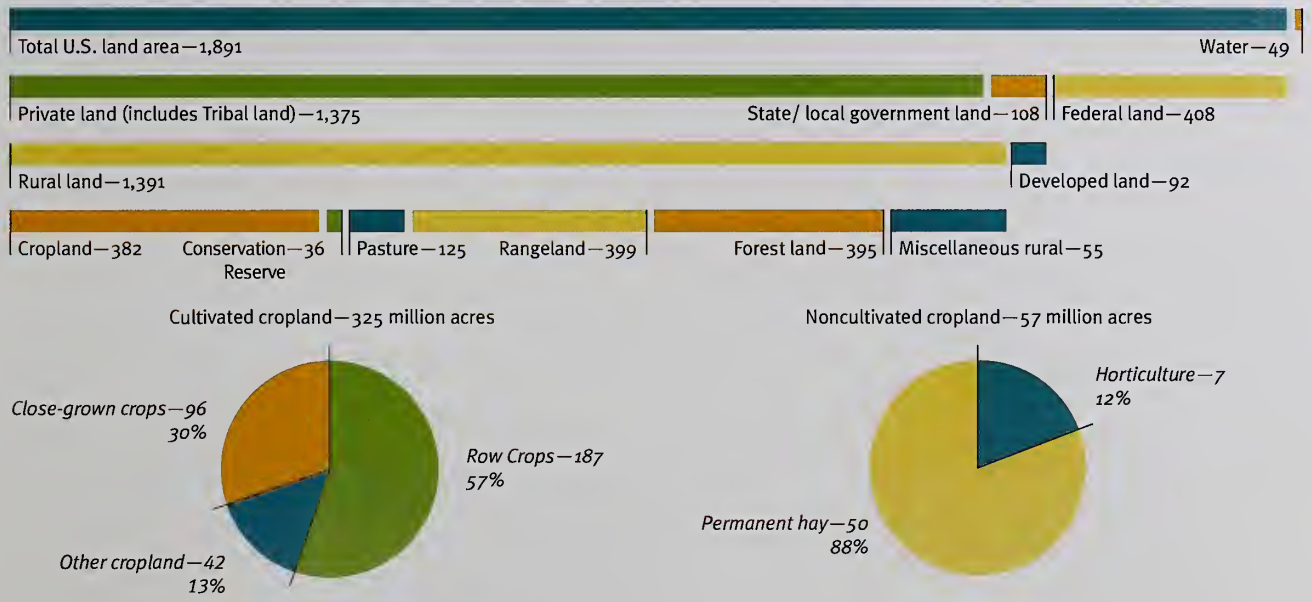
Sustainability and Agricultural Research

Sustainability simply means that resources should be used to provide for the needs of the present generation without compromising the ability of future generations to meet their own needs. The National Agricultural Research, Extension, and Teaching Policy Act of 1977 identified sustainability in agriculture as a goal of the U.S. agricultural research system. The research system was directed to invest in research that would:

- Satisfy human food and fiber needs.
- ***Enhance environmental quality and the natural resource base upon which the agriculture economy depends.***
- ***Make the most efficient use of non-renewable natural biological cycles and controls.***
- Sustain the economic viability of farm operations.
- Enhance the quality of life for farmers and society as a whole.

Subsequent agricultural acts elaborated on the goals set out in 1977. The Food Security Act of 1985 contained several significant conservation measures, and more such measures were added in the Food, Agriculture, Conservation, and Trade Act of 1990. The 1990 act stated six specific challenges for the agricultural research system that reflected a blend of the traditional production focus and the concerns about agriculture's connection with environmental and human health and the well-being of rural populations. The newest farm bill (Federal Agriculture Improvement and Reform Act of 1996) expands on these earlier themes, challenging the research system to:

- Increase the long-term productivity of the U.S. agriculture and food industry while maintaining and enhancing the natural resource base on which rural America and the U.S. agricultural economy depend.
- Support agricultural research and extension to promote economic opportunity in rural communities and to meet the increasing demand for information and technology transfer throughout the U.S. agricultural industry.
- Improve the safe production and processing of, and adding of value to, U.S. food and fiber resources using methods that maintain the balance between yield and environmental soundness.



Millions of acres in the 48 contiguous states, Hawaii, Puerto Rico, and the U.S. Virgin Islands.

Source:
USDA/NRCS National Resources Inventory, 1992

healthy, the ecosystem has an opportunity to remain healthy. If soil and water are unhealthy or deteriorating in quality, the system is probably unsustainable unless these trends are reversed

Agriculture's Impact on the Land

The extent and importance of agriculture in the United States means that we cannot accurately assess the health of our land–read the land–without a special focus on agriculture. Across our expansive and diverse landscape, Americans produce at least two hundred different crops. Amid this diversity, however, four crops–hay, wheat, corn, and soybeans–account for about 80 percent of the acreage planted each year, and livestock production–beef and dairy cattle, poultry, and hogs–accounts for slightly more than half of the total value of all farm sales. Major fiber products include timber, cotton, wool, and hides. Private, nonindustrial forests–those not owned by companies that also have wood-processing facilities–produce about half the Nation's timber supply.

While some of agriculture's environmental impact can be assessed within an individual field or farm ownership, there is some that cannot. Few farms are large enough to encompass an entire landscape or watershed, and even those farms that are exceptionally large are ecologically linked to neighboring land, including nonagricultural land. Everybody is somebody's neighbor.

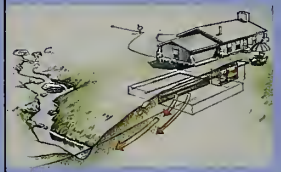
The continued dominance of agricultural land use, combined with the growth and dispersal of people into suburban and rural areas, means that the quality of the Nation's environment and the sustained productivity of the land depends more

Everybody is Somebody's Neighbor

Development in formerly rural, agricultural areas is placing increased pressures on watersheds. The growth in developed land and specifically urban and suburban land has natural resource implications far beyond loss of productive agricultural land. With development comes paved surfaces, automobile traffic, and residential chemical use, among others.

When the Sky Falls
Even though a watershed may be free of smokestacks, winds may still bring acidic substances from surrounding cities and industries as well as nitrogen from automobile exhaust and phosphorous from windblown soil.

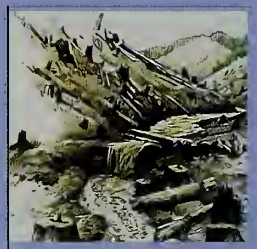
Septic Seep
Like a full sponge, aging septic drain fields that treat sewage by slow filtration, and overloaded sludge-holding tanks can leak bacteria, nitrate, and liquid poisons into groundwater. Homeowners with septic systems can reduce this risk by pumping tanks regularly and avoid introducing solvents or other potential pollutants into the septic system.



Urban Ooze
As fields are paved for roads and parking lots, rainfall moves faster off the land. This torrent picks up debris and pollutants and can cause flooding, scour riverbanks, and prevent the slow filtration of water needed to recharge groundwater.

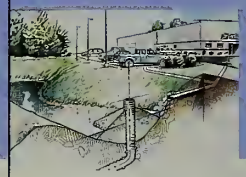
Natural Filters
Key to a healthy watershed, low-lying wetlands trap runoff and filter its sediments through natural vegetation. Protecting and restoring wetlands offer opportunities to increase the extent of these natural filtration systems.

Construction
Soil erosion from development can be controlled with filter fences and water diversions, or trapped in sediment basins. Protective buffers can be planted or existing waterside vegetation maintained to further reduce sediment loss to nearby streams and rivers.



Forests
Logging can cause serious sediment problems for streams. Soil erosion from clear cut slopes and access roads can contribute large amounts of sediment to nearby streams and rivers. Greenways along streams and cutting practices that leave tree roots in the soil can help to trap sediment.

Sediment Traps
Large development sites can install sediment traps that catch stormwater and control runoff. Ponds may be two-tiered: one with an impervious lining to settle out sediment and potential pollutants and another that promotes slow infiltration of rainwater into the aquifer. Sediment ponds may also provide habitat for certain waterfowl species.



On the Farm
As suburban sprawl intensifies, farm numbers are dwindling in many formerly rural watersheds. Remaining farms can help to protect the watershed by improving pesticide and nutrient management, fencing livestock away from streams, and making use of natural predators in pest control to reduce pesticide use.

Leafy Buffers
Lacking a cushion of wetlands, streams can still be partly shielded from runoff and sediments. Setbacks from lakes and creeks and planting of waterside shrubs and other vegetation can help to trap sediment, slow flow, and provide shade and wildlife habitat.

Art by C. Bruce Morser
Source: Adapted from National Geographic, February 1996.

than ever on how people relate to the land. How America's farmers and ranchers use and manage their land is, therefore, key to producing the nontraditional agricultural commodities that people value and to maintaining healthy, stable landscapes and watersheds. Moreover, the continuing dispersal of urban and suburban residents into rural areas virtually guarantees heightened interest among the newcomers in agriculture's environmental performance.

Some of our society's deepest social and cultural values are tied to land ownership and to the rights and responsibilities associated with private property. Defining and establishing property boundaries have great legal and economic meaning; however, they are seldom ecologically meaningful. Straight lines laid out by surveyors establish rectangular spaces on a complex landscape where most natural boundaries are curved or better defined as transition zones. As such, these established boundaries often divide naturally functioning systems.

Understanding the degree to which agriculture in a region meets the public's needs and expectations for a healthy environment, therefore, requires a view that encompasses many ownerships. Each owner's actions are important, not just because they affect that particular piece of land, but also because they affect neighboring land and the health of the larger ecosystems and watersheds in which they occur.

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Larry Lefever / Grant Heilman Photography

Letting Farmland Stay Farmland

Conversion of farmland to nonfarm uses may change land use irreversibly and alter the character of an area. It also may weaken the local agricultural economy. In heavily developed areas, loss of even a few acres of remaining farmland suggests for many the end of a way of life and separation of people from their roots.

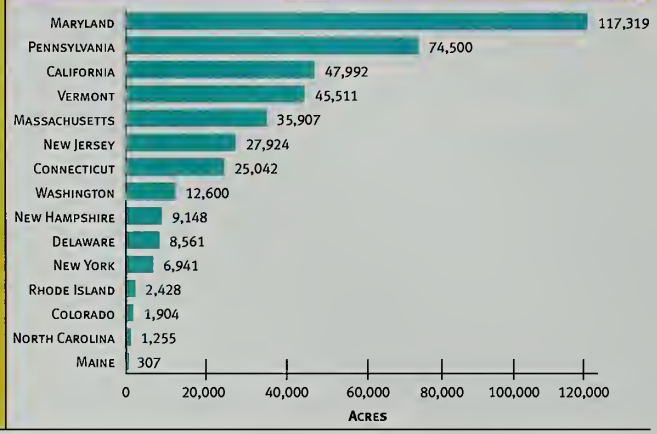
Fifteen states, mostly in the Northeast, have enacted laws and appropriated funds to pay farmers willing to keep their land in an agricultural use. Easements stay with the land even after its sale, guaranteeing that farmland stays farmland.

Since the mid-1970s, farmland preservation laws have protected nearly 420,000 acres of farmland at a cost of almost $730 million–about $1,750 an acre. Funding for the programs has come mostly from sale of bonds and levy of sales, property, and other taxes. An additional $195 million was available early in 1996 for further purchases– $107 million in New Jersey alone.

Among the leaders in farmland protection are Maryland, which has spent about $125 million to purchase easements on 117,000 acres of farmland, and Pennsylvania, which has spent more than $150 million to protect almost 75,000 acres. Massachusetts and New Jersey have each spent more than $80 million to protect 35,907 acres and 27,924 acres, respectively.

The Federal Agriculture Improvement and Reform Act of 1996 established a Farmland Protection Program with a funding level of $35 million. The program will help states with farmland protection programs purchase conservation easements. Prior to the end of the 1996 Federal fiscal year, $15 million were made available under the new program in 17 states through 37 individual programs. An estimated 150 to 200 farms will be signed up under these various programs.

LETTING FARMLAND STAY FARMLAND



Source:
American Farmland Trust, 1996

Ever-Changing Land Use

Use and management of private land change constantly in response to economic, social, and environmental forces. The amount of cropland in the United States has remained essentially the same since the 1920s, for example; but during those intervening decades, changes in agricultural markets, technology, and practice have dramatically affected the location and use of that cropland. Millions of acres of what was once cropland now support forests in the northeastern and southern states. Mississippi River bottomland forest and Great Plains grassland are cropped instead. Millions of other cropland acres have been converted for residential, business, and industrial uses.

Farm numbers have declined dramatically, and average farm size has increased proportionately. Today, there are about 2 million farms. The number of farms in both the small and large ownership categories has increased, while the number of mid-size farms has dwindled.

This increasing pattern of small ownerships, coupled with rapid population growth in many rural areas, means a dramatic increase in the "edge effect" as urban land uses press into rural ones. Rural homesites and "ranchettes" increasingly mix with prime farm and forest land. The conflicts that develop between rural residents and agriculture make commercial production more expensive and difficult. Increasing taxes, regulations, and land prices often lead farm and forest landowners to give up and sell out.

The increasingly complex mix of urban and rural land uses also has natural resource impacts that extend well beyond land use competition. Urbanization brings streets and rooftops that run stormwater directly into drains and drainageways instead of filtering it naturally through the soil. There are new pollutants as well, such as oil leaked from automobiles or chemi-

cals leached from suburban lawns. Watersheds where the maintenance of healthy conditions formerly depended on the land stewardship of a few dozen agricultural managers now often rely on the actions of hundreds of small landowners, making the task of developing effective, cooperative efforts all the more difficult and necessary.

Changes in land use obviously affect the landscape and the environment. The first step in helping to ensure that those changes are not harmful is to evaluate current land use trends and assess how well the basic natural resources–soil, water, air, plants, and animals–are faring. Good evaluation and assessment enable landowners to use and manage their land within its capabilities.

High Quality Farmland and Population Settlement

High quality farmland includes areas that in 1992 had large amounts of prime (greater than or equal to 25 percent) farmland and large tracts (greater than or equal to 3,000 acres) of unique farmland. Unique farmland is used to grow vegetables and horticultural crops.

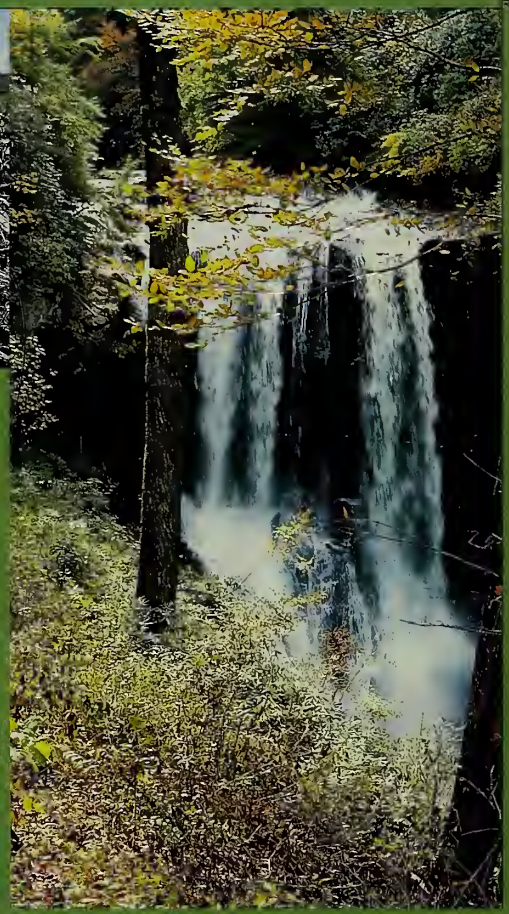
LEGEND

- Concentrations of Unique Farmland (minimum 3,000 acres)
- Concentrations of Prime Farmland (minimum 25 percent)
- Populated Areas

Source:
American Farmland Trust and the Laboratory for Cartography and Spatial Analysis, Northern Illinois University, 1996,

Artwork:
Diane Buric

The State of the Land



Our challenge as we attempt to read America's land is not a lack of data. Computers full of figures and books with myriad tables and graphs are essential to this process, but they often overwhelm us with data and give us little in the way of useful information. Still we can use these data to construct an overall picture that, in a sense, represents the land's condition or health. Complicating that task, of course, is the need to create the picture in terms of space–how particular conditions relate to each other over large areas, such as watersheds or states or regions–and time–how today's conditions relate to the past, indicating if our path is one of improvement or deterioration.

Natural resource concerns today are different from what they were in the Dust Bowl era, so we ask different questions and seek different insights. Fortunately, we have the latest in modern technology to help interpret today's information. Our grandchildren may well raise questions we have not yet thought of and use technologies we can only imagine. Such realities are an integral part of our continued learning and living on this vast and complex American landscape.

So what is the state of America's private land today? Is there a reason for hope? We think so! What follows is a snapshot of land use change, soil erosion and quality estimates, water quality and quantity, and wildlife numbers and trends. These are only the pieces of a national portrait of our land. Each is important only if we can see how it connects or relates to the others and to the well-being of the people whose lives depend upon the health of the landscape.

About two-thirds of the total value of U.S. agricultural production takes place in or adjacent to metropolitan counties.

America's Private Land

We in the United States are endowed with an enormous and complex landscape. Its highly variable geography and climate lend themselves to a great array of soil, water, and vegetative conditions. Most privately owned land is in an agricultural use–crops, grazing, or forest. Although urban land has nearly tripled since 1945, it remains less than 3 percent of total land use.

About one-fifth of the Nation's land is used for crops (382 million acres), most of which is in row crops, such as corn, cotton, oilseeds, and vegetables, or close-grown crops, such as wheat, rice, and barley. Grazing land, which includes rangeland and pasture, accounts for one-quarter of our Nation's private land (525 million acres). Rangeland is found in nearly every state, although it is concentrated in the West. Privately owned rangeland totals about 399 million acres. Pasture is often part of a crop rotation or a permanent use of land too difficult to till. Most of the 126 million acres of pasture are in the humid eastern half of the United States.

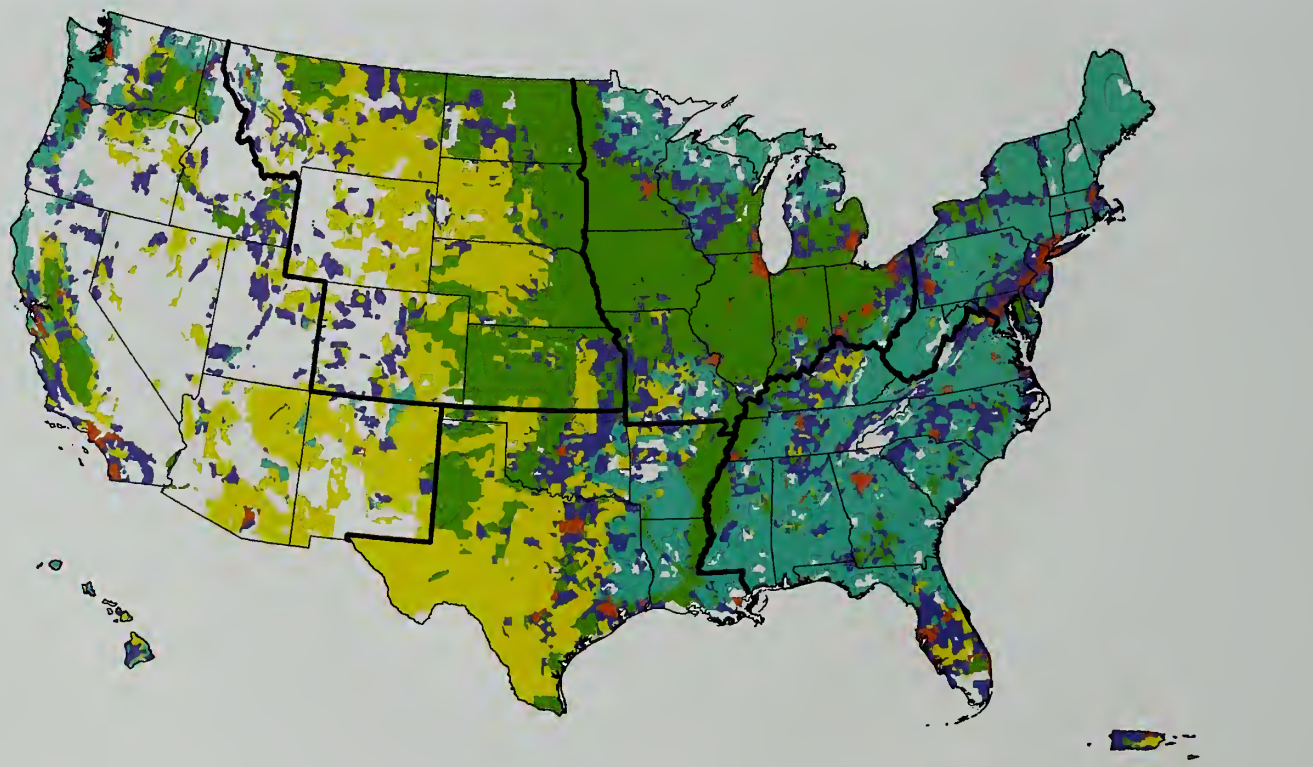
Dominant Land Uses, 1992

Land Uses Occupying Over 50% of Area.

LEGEND

- Developed Land
- Cropland
- Rangeland/Pasture
- Forest Land
- Mix of Two or More Land Uses
- Federal Land/Water/Non-Sampled Area

Source:
USDA/NRCS National Resources Inventory, #RWH.1542, 1992

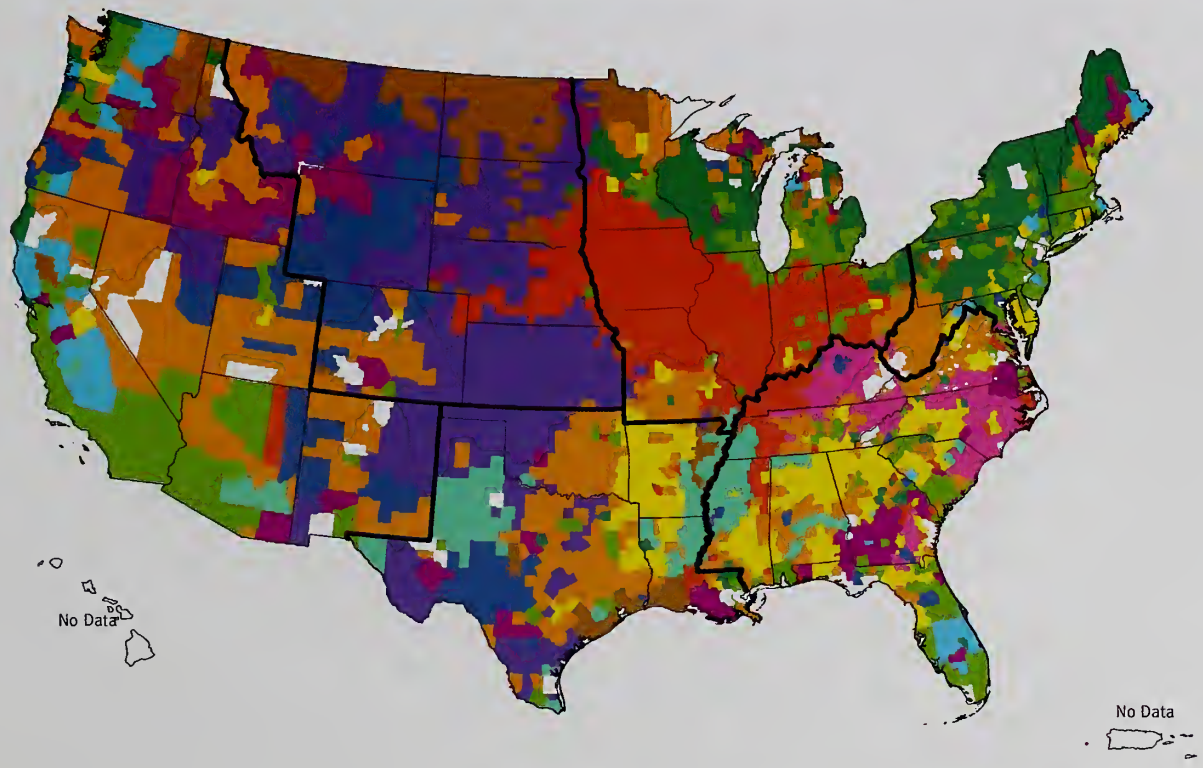


Privately owned forests comprise another one-fifth of our Nation's private land (395 million acres). The majority of private forest is concentrated in the East, where marginal crop and pasture land has gradually reverted to forest. Almost half of the Nation's timber supply in 1992 came from private, nonindustrial forests, even though almost 90 percent of those forests are less than 100 acres in size and most such ownerships are held primarily for recreational, homesite, or similar purposes.

Land Productivity and Diversity

The U.S. agriculture and food system is an integral component of our national economy, contributing $950.2 billion (15.7 percent) to the Nation's gross domestic product in 1992 and accounting for at least 18 percent of the Nation's 127 million civilian jobs. It varies widely in enterprise size, scale, resource use, product mix, and interaction with the nonfarm sector. Major grain crops, for example, are found in the Nation's central breadbasket (Midwest and Northern Plains); most timber

Patterns of Agricultural Diversity



Each of the cluster categories represents farm types that are similar in terms of commodities produced, farm resources, and employment and income on- and off-farm. Eastern and southeastern states are characterized by smaller, more diverse production activities (e.g., mixed dairy, woodlots, specialty crops) than those in the Midwest and Northern Plains.

LEGEND

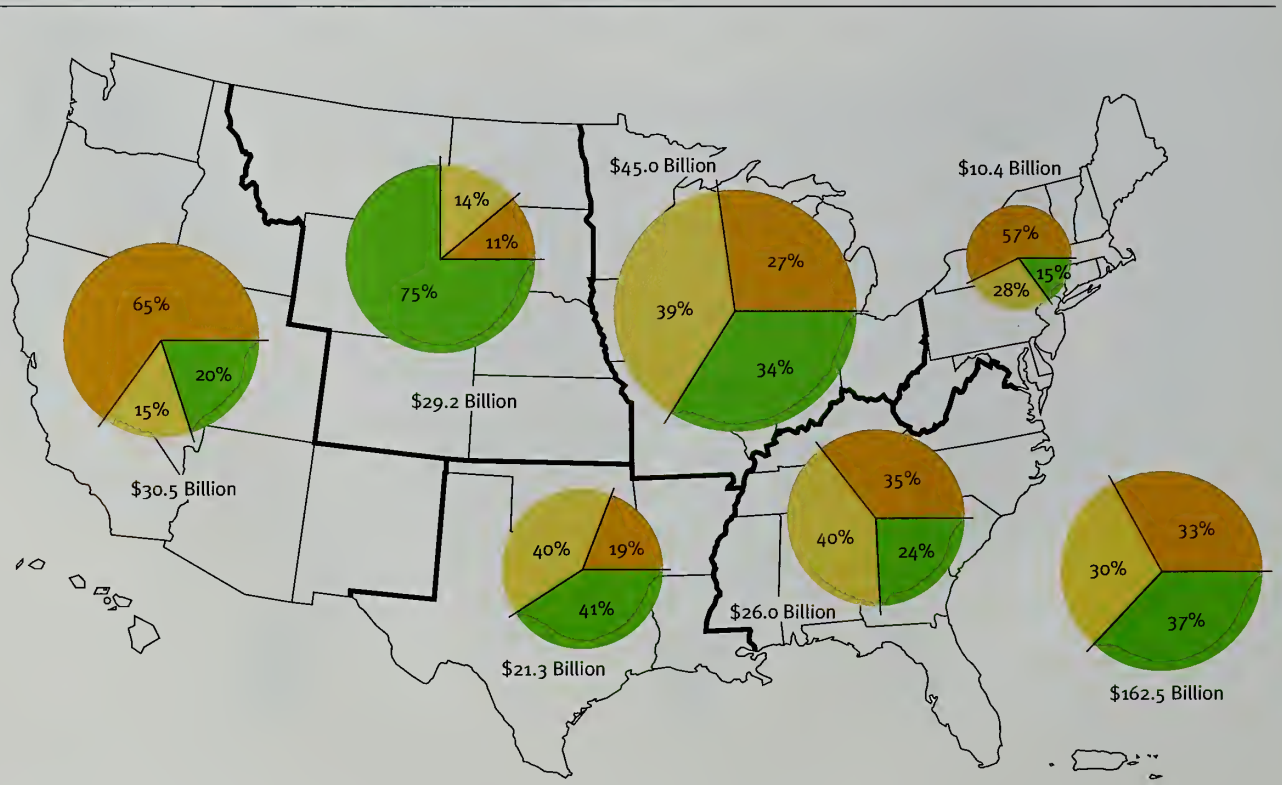
- Corn, Soybeans, Hogs
- Poultry
- Dairy
- Cattle, Wheat, Sorghum
- Tobacco
- Part-time Cattle
- Fruit
- Other Crops
- Vegetables, Nursery Products
- Wheat, Oats, Other Grains
- Cotton
- Sheep, Cattle, Other Livestock
- Insufficient Data

Source:
USDA Economic Research Service, Diversity in U.S. Agriculture (Rep. #646), #RWH.1472, 1991

production, industrial and nonindustrial, takes place in the Northwest and Southeast; rangeland characterizes the arid and semiarid West. Specialty products, such as fruits, vegetables, and horticultural crops, are commonly found near metropolitan areas, where almost two-thirds of U.S. agricultural production–valuewise–occurs.

Agriculture has a significant economic influence in metropolitan areas of the United States. In 1992, agricultural production in metropolitan counties accounted for $53.6 billion; production value in counties adjacent to metropolitan areas accounted for another $48.7 billion. Based on sales per acre, urban-fringe agriculture is two and a half times as productive as rural agriculture. Some of these farms are associated with innovative marketing techniques, such as "pick-your-own" operations that also provide recreation and a connection to the land for urban and suburban residents.

Value of Agricultural Production by Proximity to Metro Areas



National Resources Inventory: From Data to Information

For more than 50 years, the U.S. Department of Agriculture has "read" the land through conservation needs assessments and natural resource inventories. One of USDA's principal data gathering efforts today is the Natural Resources Conservation Service's National Resources Inventory (NRI), the Nation's most comprehensive program for gathering data and presenting information on the condition and trends on nonfederal land in the United States. Detailed NRI information is available for the 48 contiguous states, Hawaii, Puerto Rico, and the U.S. Virgin Islands. Similar, though less extensive, information is under development for Alaska and certain Pacific Basin islands. The NRI is a multiresource inventory based on soils and other natural resource data collected at sample sites–800,000 sites in 1992. It provides a record of the Nation's conservation accomplishments and needs. The database currently includes data from 3 inventory years–1982, 1987, and 1992.

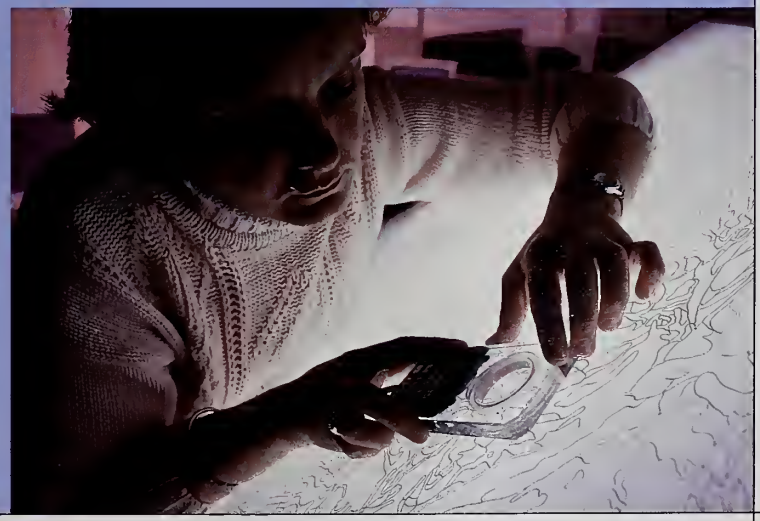
Each NRI has expanded and improved upon the previous one. For example, the 1992 NRI added a first measure of wildlife habitat diversity. Today, the NRI and other data collection efforts are being coordinated to achieve a continuous monitoring and assessment of natural resource conditions and trends.

NRCS is also developing new indicators that can be used to measure natural resource and ecosystem health. These new indicators will:

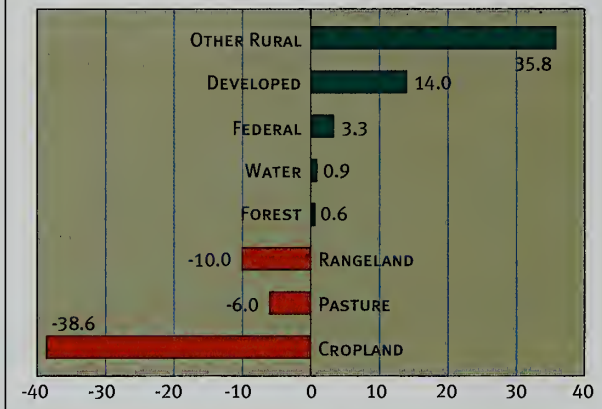
- Enable people to assess ecosystem conditions, including ecological, social, and economic elements.
- Allow quantification of objectives, use of analytic tools, and integration of multiple objectives within the planning process.
- Evaluate the effects of broad-scale program and management actions in order to make corrections in implementation plans or goals and to increase the knowledge of how systems respond to management changes.
- Enable public interest groups, professional resource managers, public agencies, nongovernmental organizations, and others to evaluate ecosystem conditions using a common set of terms and methods.

NRI information can be used to formulate policy and evaluate programs at national, regional, state, and multi-county levels. When combined with other Federal, state, and local government inventories, the NRI can provide a snapshot of the state of the land and identify natural resource trends. NRCS field offices and new information dissemination systems, such as the Internet, will become increasingly important in getting this information to the people who most need it: landowners and natural resource managers.

Many maps in this report are based on NRI data. Each sample point in the NRI database is linked to specific geographic areas–county, hydrologic unit (watershed), and Major Land Resource Area. With this linkage, NRI data can be mapped to geographic areas of interest for natural resource analysis. Those estimates are generated using weighted averages or sums for the data from the appropriate sample points. Caution is thus needed when making highly localized interpretations based on NRI maps. NRI data are statistically reliable only at certain substate levels. The specific level of reliability varies by area, density of sample points, and nature of the resource feature being estimated.



Net Changes in Use of Nonfederal Rural Land, 1982-1992 (million acres)



Other rural land is primarily composed of CRP acres, but also includes farmsteads and other farm structures, field windbreaks, barren land, and marshland.

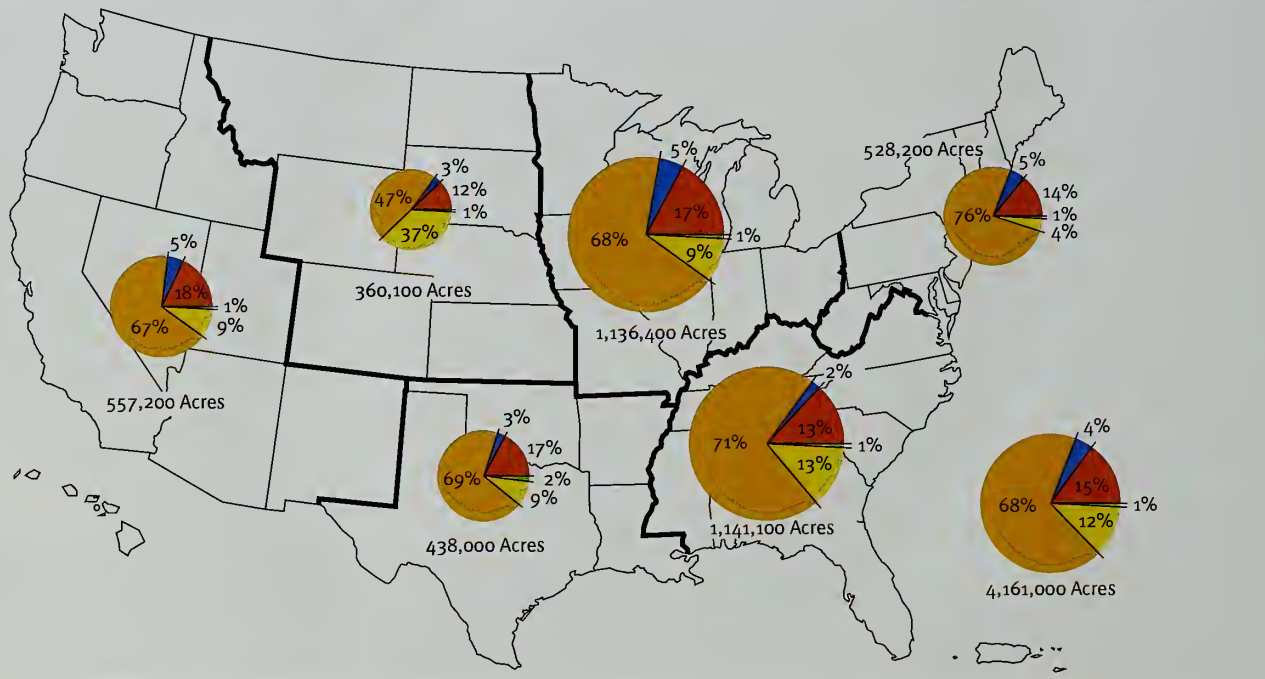
Source:
USDA/NRCS National Resources Inventory, 1992

The Land Dynamic

Land shifts into and out of various uses. Between 1982 and 1992, the net amount of land devoted to crops, pasture, and range declined by 39 million cropland acres (of which 36.4 million were enrolled in the Conservation Reserve Program), 6 million pasture acres, and 10 million rangeland acres. Forest land showed a modest increase during the period.

The net acreage gained or lost to different land uses reveals only part of the story. Although 60 million acres shifted from cropland to other uses between 1982 and 1992, about 21 million acres shifted from other uses into cropland during this same period. Nearly 3 million acres of cropland were developed for residential purposes (or 68 percent of total

Cropland Converted to Developed Land, 1982-1992

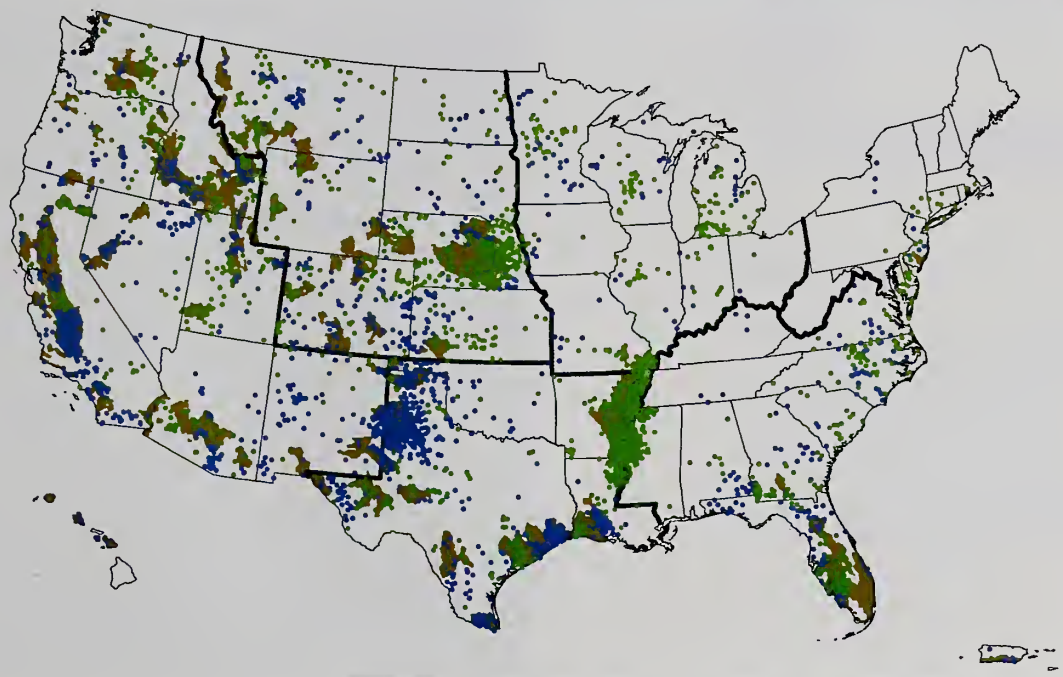


conversions). But this rate had slowed compared to earlier decades. The 10-year rate of expansion in urban areas (18 percent) was half the rate of growth in the 1950s (39 percent).

As agricultural land is converted, its contribution to local economies declines. The total value of agricultural production in the Central Valley of California could drop by as much as $2 billion annually as a result of low-density urban sprawl, an amount roughly equal to the entire agricultural production of New York, Virginia, Oregon, or Mississippi. Farmland preservation surrounding some urban areas is undertaken at least in part to preserve the feeling of openness that is so important to us. Scenic vistas with a minimum of manmade obstructions have been shown to reduce the stress of modern living. Natural areas provide us with opportunities for reflection, rest, and renewal.

Land use changes also may occur when one use is abandoned because it can no longer be supported economically. In 1992, about 62 million acres of agricultural land were irrigated, down only slightly from 1982. But a regional shift was evident. Irrigated acreage in the western states declined substantially as the use of groundwater for irrigation became uneconomical. Conversely, irrigation expanded in the eastern United States, in part reflecting producers' efforts to reduce risk from drought. Irrigation in relatively humid areas is supplemental, with precipitation meeting the crop's major water needs.

NET GAINS AND LOSSES IN IRRIGATED CROPLAND ACREAGE, 1982-1992



Percent of Cropland Area in Irrigation

LEGEND

- Greater Than 50%
- Less Than 5% Cropland or Less Than 50% Irrigation in Sample
- 1 Green Dot = 2,500 Acres Net Gain
- 1 Blue Dot = 2,500 Acres Net Loss

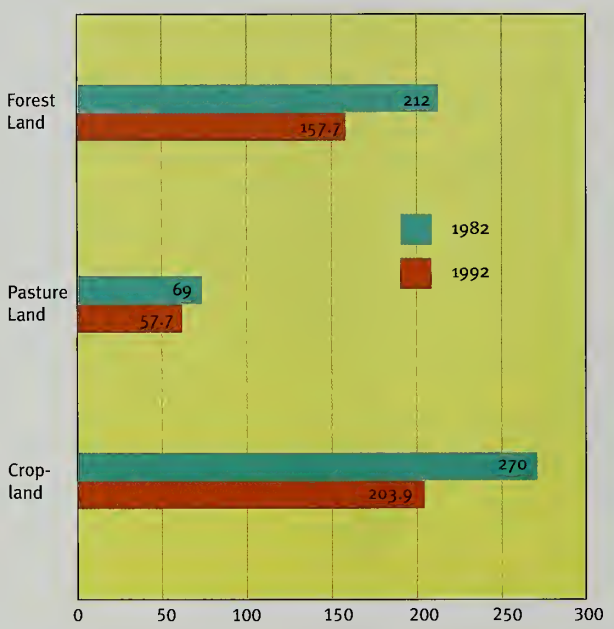
Source:
USDA/NRCS National Resources Inventory, #RWH.1607, 1992

Protecting and Enhancing Agricultural Productivity

The amount of cropland still requiring conservation treatment to maintain productivity declined by nearly a quarter between 1982 and 1992, in part because of land retirement, but also because of producers' adoption of soil-conserving crop management practices, such as conservation tillage. Pasture and forest acres needing conservation treatment also declined between 1982 and 1992. Conservation treatment, primarily forage improvement, was needed on 46 percent of pasture land in 1992, a decline from 53 percent requiring treatment in 1982.

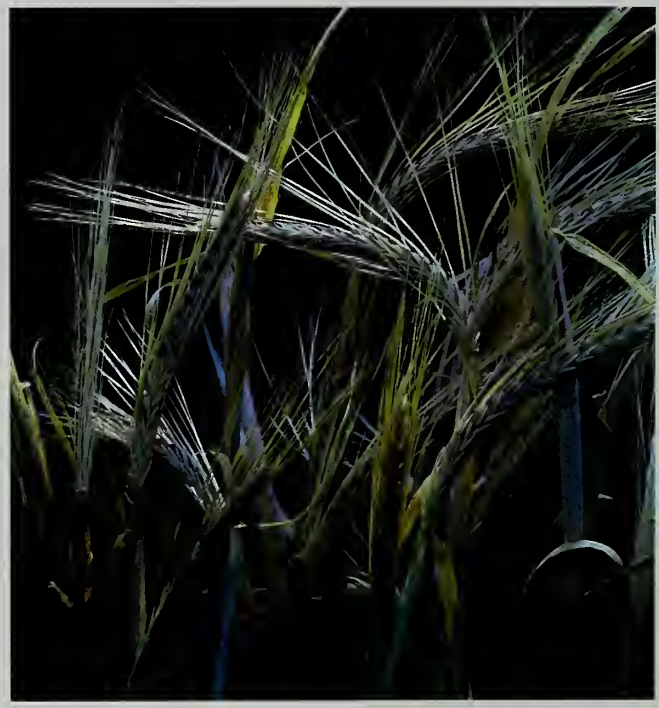
Private, nonindustrial forest concerns include structural and biological diversity, fuel-loading and fire management, insects and disease, pollution, and riparian area damage. Aging, overcrowded stands are more likely to be stressed by insect and disease attacks and environmental changes, such as drought and pollution. Northern and eastern forests in particular are threatened by ozone and acidic deposition, and large areas of loblolly pine in the South are subject to damage from drought stress and insects. In the West, fuel-loading and wildfire are the major concerns. Between 1986 and 1991, timber mortality increased in all regions of the country.

Acres Needing Conservation Treatment by Land Use, 1982 and 1992 (million acres)



Conservation treatment needs are based on the judgment of a qualified specialist using the NRCS technical guide and information about the prevailing agricultural operations. The specialist can record up to three conservation treatments needed to sustain and enhance soil, water, plant, and animal resources. Conservation treatments include erosion control, drainage, irrigation management, various forms of forage improvement and reestablishment, and toxic salt reduction. Data on rangeland conservation needs are available only in preliminary form.

Source:
USDA/NRCS National Resources Inventory, 1982 and 1992

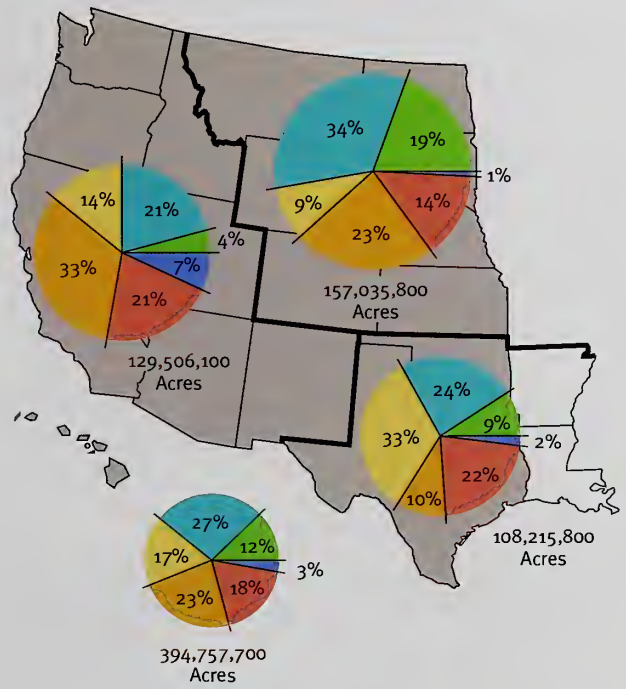


The bulk of private rangeland evaluated in 1992 (59 percent) exhibited some form of disturbance that affected its productive capacity. Accelerated soil erosion threatens sustained production on at least a fifth of all rangeland acres. Invasive weeds and unwanted brush are the other major management problems on rangeland, adversely affecting at least 69 million acres–about 17 percent of all rangeland. Invasive perennial weed species are distributed across the entire West, posing a significant hazard to rangeland health specifically. Leafy spurge is one of the most notable and damaging of the invasive perennial weeds.

Irrigation in arid and semiarid regions often concentrates salts in soil and water, sometimes creating severe production and environmental problems. About 570 million acres (30 percent) of the contiguous United States have a moderate to severe potential for soil and water salinity problems. Saline soils contain sufficient soluble salts to adversely affect plant growth. At least 48 million acres of cropland and pasture are currently affected. Reclaiming saline soils economically is difficult, if not impossible. Salinized soil is lost to agricultural production, at least in the near term. In 1971, 81,430 acres of saline-affected cropland had been taken out of production in Montana. By 1987, that figure had risen to 300,000 acres (about 2 percent of Montana's total cropland). Recent surveys indicate that affected areas are growing at a rate of 10 percent a year.

Conservation gains are seldom permanent. Changes in conservation technology and application are challenged to keep pace with natural resource conditions, land use, market forces, and production technology and trends. The years between 1982 and 1992 were significant in terms of conservation gains. During this period, new agricultural conservation policies were put in place that reduced conversion of wetlands to cropland, required compliance with soil conservation provisions as a feature of par-

Rangeland Status in the Western United States, 1992



A little over half of all U.S. land is classified as rangeland (1.2 billion acres). Of this, Alaska has the most (230 million acres). In the lower 48 states, Texas has the largest acreage (92 million), and Florida has the most acreage of any state east of the Mississippi River (2 million). Other eastern states also contain rangeland, but little information is gathered on its extent or condition. Rangeland assessment methods changed between 1982 and 1992, making a comparison of conservation treatment needs impossible.

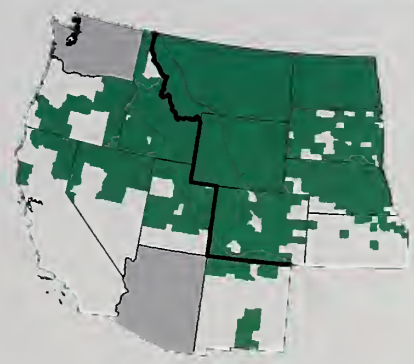
LEGEND

- No Serious Problem
- Minor Problems Correctable With Improved Management
- Brush or Weed Problems
- Accelerated Wind and Water Erosion
- Multiple Problems
- Insufficient Data
- States with Rangeland Data

NOTE:
U.S. pie is not the same scale as regional pies.

Source:
USDA/NRCS National Resources Inventory, #RWH.1711, 1992

Distribution of Leafy Spurge In the Western United States by County, 1996



LEGEND

- Leafy Spurge
- No Data Collected

Source:
USDA/NRCS, based on data from Montana State University, #RWH.1705, 1996

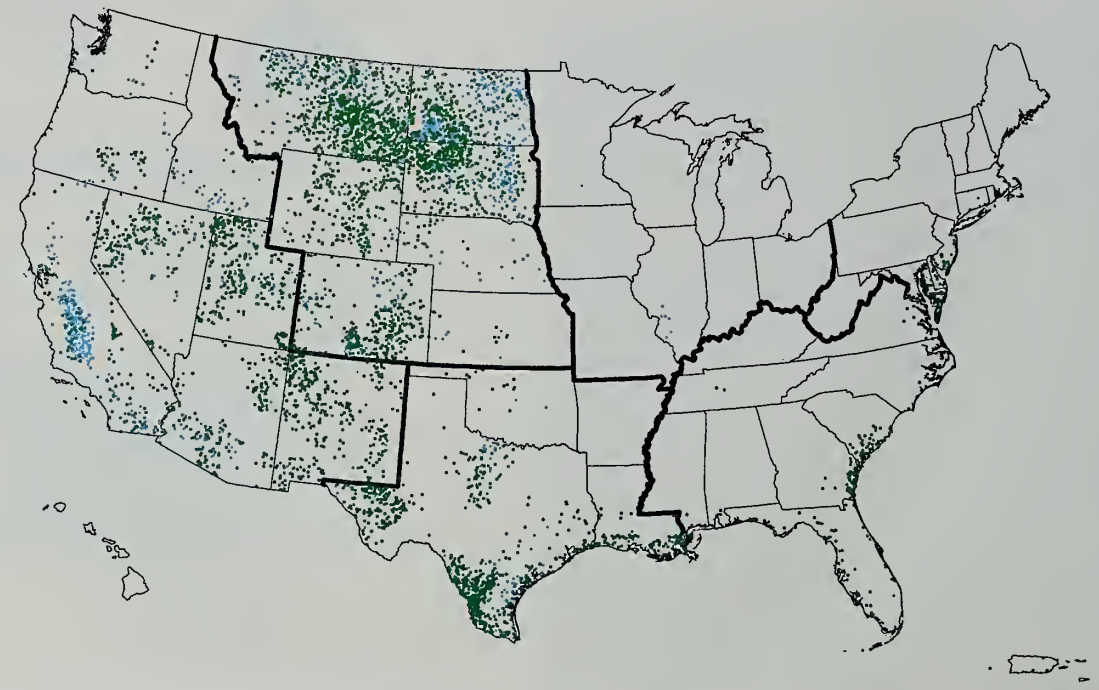
ticipation in commodity and other Federal farm programs, and encouraged long-term retirement of cropland particularly susceptible to degradation; important conservation cost-share programs also remained in place. The challenge is to expand on those accomplishments and make sure they endure. External forces may prove to have the most influence on the Nation's conservation progress. Rising world food demands, new markets, and expanding free-trade policies could encourage production on formerly retired, environmentally sensitive land.

Soil and Productivity

Soil erosion occurs naturally on all land, with at least 40 percent of the total soil erosion in the United States resulting from such activities as construction, logging, and off-road vehicle use, or natural events, such as fire, flooding, or drought. While erosion can reduce soil productivity, it also has a substantial effect on the quality of our water and atmospheric resources. A certain level of soil erosion is tolerable, meaning that it does not harm soil productivity. This level, referred to as T, varies by soil type and considers a number of factors, including the time required for new soil to form.

Salinity-Influenced Soils on Nonfederal Land, 1992

Salinity levels generally are expressed in terms of electrical conductivity. The higher the salt level the greater the conductivity. This graphic depicts areas with salinity levels greater than 4 millimhos/cm (mmho/cm), the level at which most plants are adversely affected. Salinity levels this high can alter soil structure and promote waterlogging, cause salt toxicity in plants, and reduce the plant's ability to take up water. But this is an average value. Salt-intolerant plants may be adversely affected at 2 mmho/cm, whereas salt-tolerant plants may adapt to 8 mmho/cm or more.

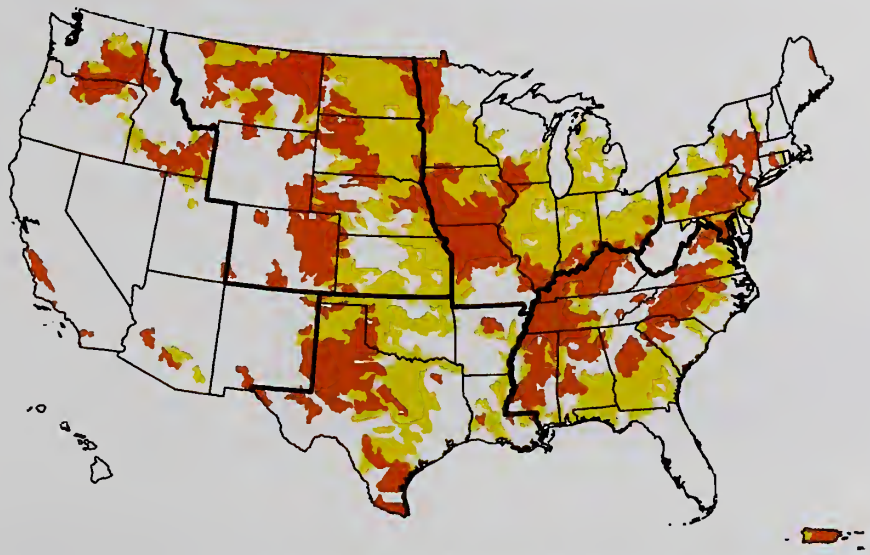


LEGEND

- 1 Green Dot=10,000 Acres Other Land
- 1 Blue Dot=10,000 Acres Cropland, CRP, and Potential Cropland

Source:
USDA/NRCS National Resources Inventory, #SMW.1597, 1992

Soil Erosion as a Proportion of the Tolerable Rate (T), 1982



Actual Soil Loss Rate/Tolerable Soil Loss Rate

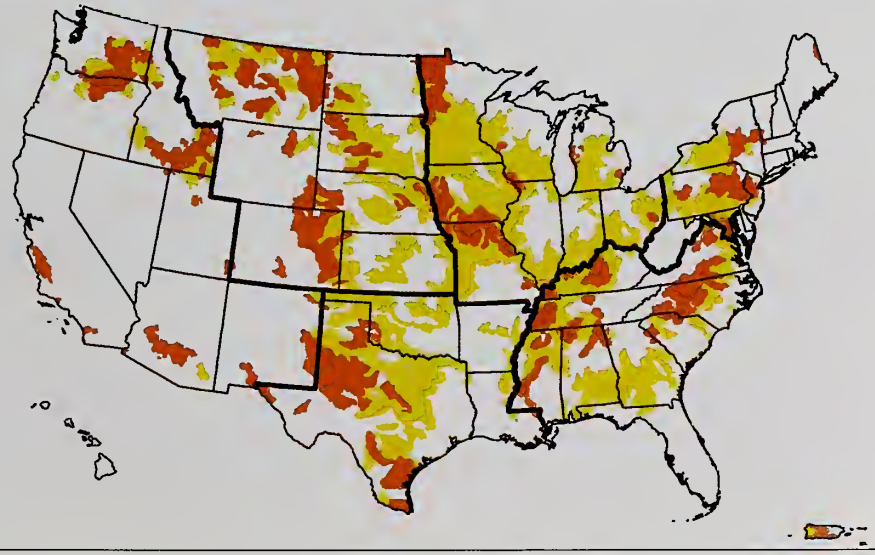
LEGEND

- 2T or More
- T-2T

NOTE:
Average annual soil erosion by wind and water where cultivated cropland is greater than 5% land area.

Source:
USDA/NRCS National Resources Inventory, #RWH.1570, 1982

Soil Erosion as a Proportion of the Tolerable Rate (T), 1992



Actual Soil Loss Rate/Tolerable Soil Loss Rate

LEGEND

- 2T or More
- T-2T

NOTE:
Average annual soil erosion by wind and water where cultivated cropland is greater than 5% land area.

Source:
USDA/NRCS National Resources Inventory, #RWH.1571, 1992

Soil erosion at rates greater than T is a special concern because it threatens agricultural sustainability. Sheet and rill erosion tends to be a greater problem in the humid East, while wind erosion is a greater problem in the arid and semiarid West. Estimates of streambank, gully, irrigation-induced, and ephemeral gully erosion currently are not included in standard soil erosion assessments. Such forms of erosion can be substantial in certain situations.

Knowing where we are today, how we got to this point, and where we are headed is the essence of reading the land.

In 1982, erosive forces moved nearly 3.1 billion tons of soil from our Nation's cropland (1.4 billion tons via wind and 1.7 billion tons via water). By 1992, soil erosion had dropped to 2.1 billion tons (0.9 billion tons via wind and 1.2 billion tons via water).

American farmers have made great strides in reducing cropland erosion using soil-conserving practices, such as crop residue management, contour tillage, stripcropping, and land retirement. Highly erodible land was the target of the first five Conservation Reserve Program sign-ups. After 13 sign-ups, U.S. farmers and ranchers had placed 36.4 million acres under CRP contracts, planting this environmentally sensitive land to trees, grasses, windbreaks, wildlife ponds and plantings, and other approved conservation practices.

CRP significantly improved the status of resources between 1982 and 1992. Average annual soil erosion on CRP land declined from 12.5 tons per acre per year to 1.5 tons per acre per year. The program hit its target! Erosion rates were lowered. Wildlife populations rebounded significantly in many areas as grassland and forest habitat increased, with associated gains in recreational opportunity, scenic amenities, and water quality.

Soil Erosion on Cultivated Cropland, 1982-1992

Year	Less than T* (percent of total acres)	T - 2T (percent of total acres)	Greater than 2T (percent of total acres)
Sheet and Rill Erosion			
1982 - 366,199,800 total acres	73.1	14.1	12.8
1992 - 325,462,100 total acres	78.6	12.4	9.0
Wind Erosion			
1982 - 366,199,800 total acres	78.9	9.4	11.7
1992 - 325,462,100 total acres	83.9	7.6	8.5

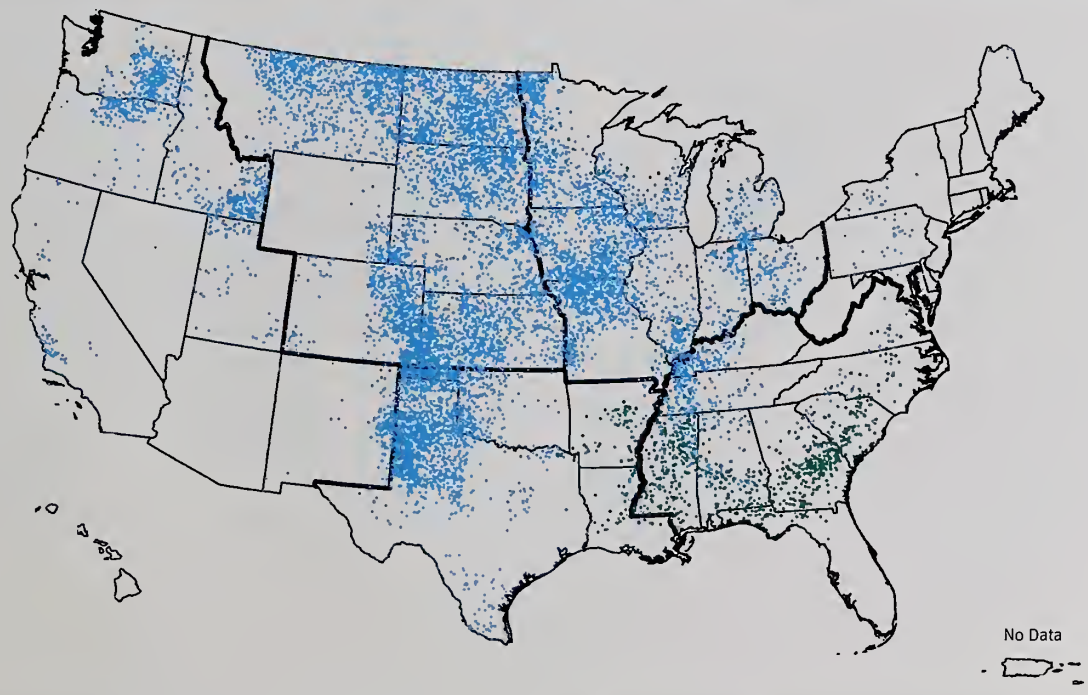
*T is the level of erosion believed tolerable on different soils to maintain productivity

Source: USDA/NRCS National Resources Inventory, 1992

Controlling soil erosion is only one aspect of improving soil quality, however. Organic matter content is an important measure of soil quality and productivity. Organic matter contributes to a soil's ability to hold nutrients and water, supports microbial life, and maintains a texture and structure conducive to plant growth. Agricultural cropping, rotation, and tillage systems profoundly influence soil organic matter content. Rotations that include cover crops or grass-based sod systems can increase soil organic matter by adding root mass to the soil. Conservation tillage, which reduces soil disturbance and maintains residue levels of at least 30 percent on a field surface, can increase soil organic matter while significantly reducing soil erosion rates.

Nationally, conservation tillage is now used on nearly as many cropland acres as conventional tillage, although regional variations are evident. About 98 million acres of cultivated cropland were under a conservation tillage system in 1995, a 37-percent increase from 1989. Conservation tillage acres are concentrated in the Midwest and Northern Plains, the only regions where the practice is undertaken on more acres than conventional or reduced tillage.

Conservation Reserve Program Acres, First Through Twelfth Sign-Up



LEGEND

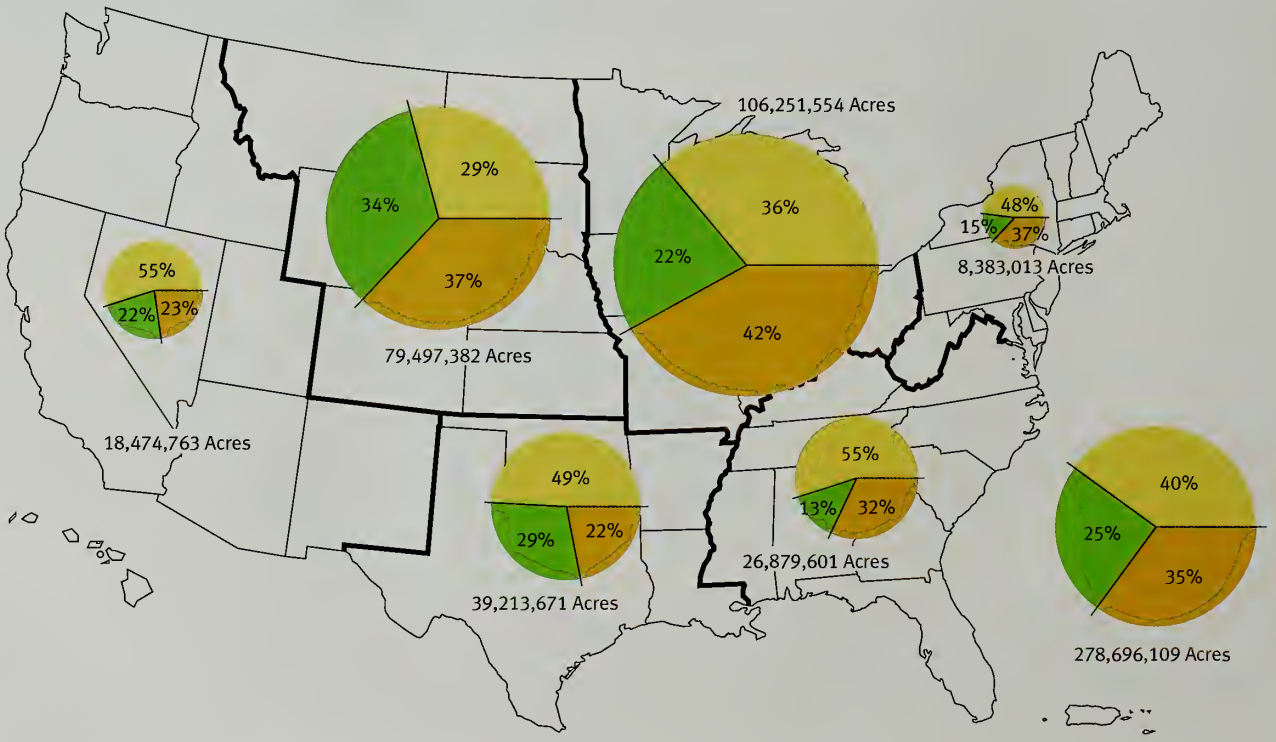
- 1 Green Dot=3,000 Acres Where Trees are Being Grown
- 1 Blue Dot=3,000 Acres Where Other Practices Are in Place

Source:
USDA/NRCS, based on CRP Contract Data, #RWH.1609, 1996

Increasing soil organic matter provides benefits far beyond improved soil productivity. Sequestration of carbon in soil organic matter reduces the accumulation of carbon dioxide–a greenhouse gas–in the atmosphere. The Earth's soil organic reservoir stores as much as three times more carbon than all of the planet's vegetation. Soil organic matter also promotes the biological activity that is fundamental to sequestering or metabolizing pesticides and fertilizers. Well-developed soil organic matter reservoirs contribute to good soil condition, promoting infiltration of rainfall and reducing runoff that might carry potential contaminants to nearby water bodies. Given the relationship between soil quality and the quality of other natural resources, soil conservation is central to maintaining healthy ecosystems.

Tillage Practices by Region, 1995

Tillage practices are distinguished in part by the level of residue left on the soil surface. Conventional tillage, which completely inverts the soil and promotes oxidation of the organic matter reservoir, maintains residue levels of less than 15 percent on the soil surface. Conservation tillage maintains residue levels of at least 30 percent, and reduced tillage is intermediate, between 15 and 30 percent.



NOTE:
U.S. pie is not the same scale as regional pies.

Source:
USDA/NRCS, based on Conservation Technology Information Center data, #RWH.1655, 1995

Ephemeral Gully Erosion: Soil Loss Not Accounted For

Ephemeral gully erosion results when water flows in small channels and swales that are routinely destroyed by tillage or along field edges where ridged rows or wheel tracks concentrate water. Because erosion is concentrated, there is greater potential for sediment to leave the field and enter a waterbody. Most ephemeral gullies occur on fields with highly erodible soils, little or no crop residue cover, or where crop harvest disturbs the soil (potatoes, peanuts, carrots, onions, etc.).

Ephemeral gully erosion is not accounted for in current soil loss assessment programs. But it can be significant in many watersheds, depending upon climatic, landscape, soil, and cultural factors. In recent studies of ephemeral gully erosion in 19 states, the amount of erosion ranged from an additional 21 percent to 275 percent of the estimated sheet and rill erosion on the field.

Because ephemeral gully erosion is associated with water flow, it tends to be greater where runoff is great–southern coastal states and northern-tier states where snowmelt runoff is significant. Ephemeral gullies can be controlled by controlling surface water runoff with such practices as diversions, contoured grass buffer strips, waterways, terraces, underground outlets, or stripcropping.

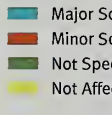
Location	Estimated Annual Sheet and Rill Erosion (tons/acre/year)	Measured Ephemeral Gully Erosion (tons/acre/year)	Ephemeral Gully Erosion as a Percentage of Sheet and Rill Erosion
Alabama[a]	15.60	9.30	59
Delaware	1.03	2.52	245
Illinois	7.10	5.20	73
Iowa	9.60	3.00	31
Kansas	21.98	8.00	36
Louisiana	17.80	6.04	34
Maine	11.21	5.15	46
Maryland	5.30	4.00	75
Michigan	4.67	1.22	26
Mississippi	17.60	7.50	43
New Jersey	6.70	5.20	77
New York	23.77	5.05	21
North Dakota	7.54	3.55	47
Pennsylvania	2.53	1.78	71
Rhode Island	9.00	3.70	41
Vermont	4.50	6.10	136
Virginia	13.0	12.80	98
Washington	0.69	1.89	275
Wisconsin	7.87	4.19	53

Values in the table were developed for selected sites in the identified states. More data are needed to define the extent and severity of this type of erosion.

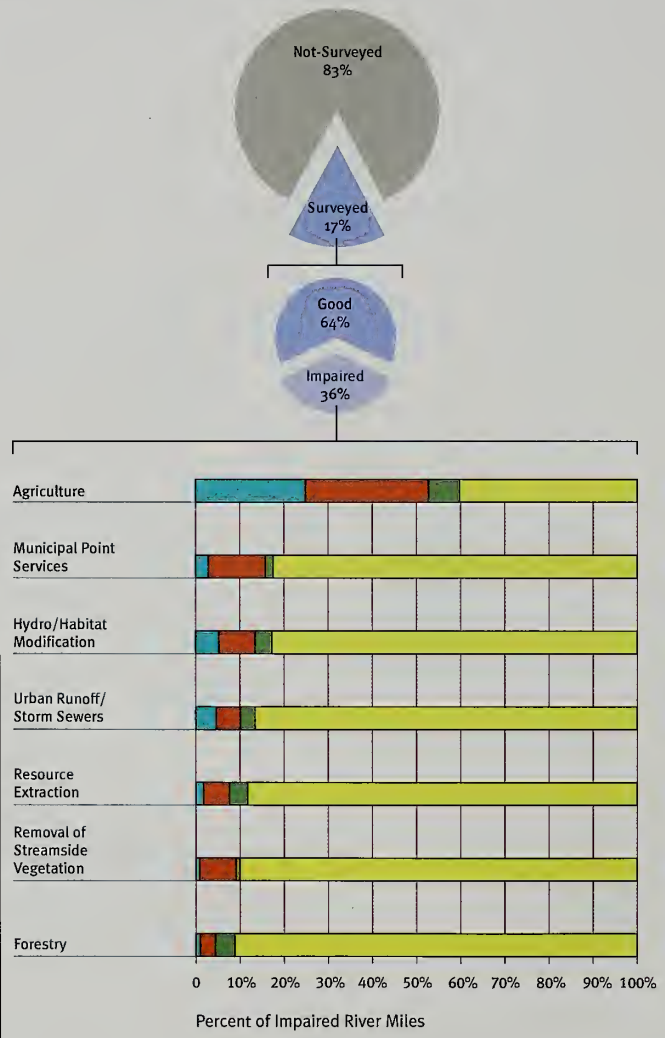
a The estimate for Alabama is an average of the data gathered from 3 locations: Southern Ridge and Valley, Southern Coastal Plain, and the Blacklands Prairies.

Leading Sources of Impairment of U.S. River Miles, U.S. Environmental Protection Agency, 305 (b), 1994

While 305(b) data provides insight into public perceptions of the quality of water resources, limitations on the use of the data exist. First, the data cannot be used to estimate national water quality trends over time. Second, the data cannot be used to compare the status of waters among states. These limitations result from the variability in states' assessment efforts (including the comprehensive nature of the assessment, the objectives, and the reporting format), variability in state water quality standards, and variability in the degree to which states follow the EPA guidelines.



Source:
Adapted from U.S. Environmental Protection Agency, 1994



Agriculture Affects Water Quality

The status of the Nation's water resources (rivers, lakes, and estuaries) is assessed by states and Native American tribes in accordance with Section 305(b) of the Clean Water Act. Water quality is defined by each state and tribe for each water resource, based on the state's or tribe's determination of the water's beneficial uses (swimming, fishing, supporting aquatic life, etc.). A determination of impairment thus reflects subjective decisions as well as scientific findings.

In the 1994 assessment, states and tribes reported on 17 percent of river miles, 42 percent of lake acres, and 78 percent of estuarine square miles. Of the river miles assessed, about 64 percent were found to be of good quality, with no identified use impairments. Thirty-six percent of the assessed miles suffered from use impairments caused by one or more sources. Agriculture was found to contribute to impairment in 60 percent of the impaired river miles, equivalent to 22 percent of the total assessed river miles.

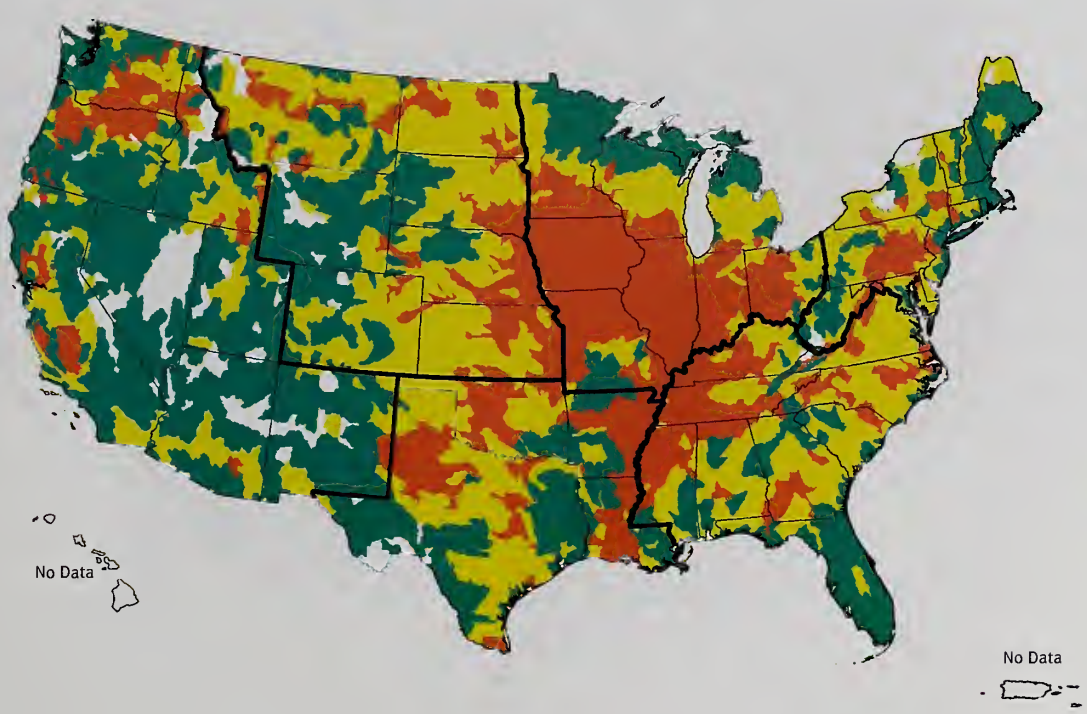
One of the major sources of water quality impairment from agriculture is the sediment, often with nutrients or chemicals adsorbed to the soil particles, that enters streams and rivers as a result of soil erosion. While eroded soil may not move directly into waterways, and prevention of field erosion does not stop soil movement within water channels, there is a direct water quality benefit when America's farmers and ranchers reduce the amount of soil that moves off their land.

Concentrated animal production sites are of particular environmental concern because of the potential for nutrient and bacterial contamination of water resources as well as odor problems affecting neighboring communities. Industrialization of the livestock production sector, spurred by economies of size and new production and processing technologies, has produced

livestock concentrations and geographic shifts unprecedented in the United States. Parts of the Southeast and West are the primary hotspots for animal manure problems, in part because of soil and climatic factors and in part because those areas lack adequate cropland on which to apply manure properly. The link between feed production and livestock concentration in the Midwest does allow, in many instances, for land application of animal manure and recycling of the nutrients in the crop production system, but that does not mean that all manure is now being handled adequately.

Nutrients, mainly nitrogen, phosphorous, and potassium, are applied to promote plant growth. If they are applied inappropriately or in excessive amounts, those beneficial materials can threaten associated water resources.

Sediment Delivered to Rivers and Streams from Sheet & Rill Erosion



This map shows estimates of sediment delivered to rivers and streams for the approximately 2,150 watersheds comprising the contiguous United States. The Universal Soil Loss Equation was used to estimate sheet and rill erosion rates for the agricultural land in each watershed (other erosion processes are not included in this estimate). Erosion rates were converted to tons of sediment delivered to streams from agricultural land using a delivery ratio formula based on an empirical relationship between soil erosion rates and sediment loads in several U.S. river basins.

Sediment Delivered

LEGEND

- High
- Medium
- Low
- None/No Data

Source:
USDA/NRCS based on data from R. Srinivasan and C. Walker, Texas Agricultural Experiment Station, 1996

Nitrate nitrogen is highly mobile and has a high potential to leach below the root zone into groundwater, volatilize into the atmosphere, or be carried overland to nearby surface waters. Phosphate, while not as mobile as nitrate, tends to be carried on soil particles that move off the field because of erosion. The potential for these and other chemicals to move from land to water is governed by a variety of factors, such as soil type, climate, and tillage practices.

Confined Livestock Concentration, 1992

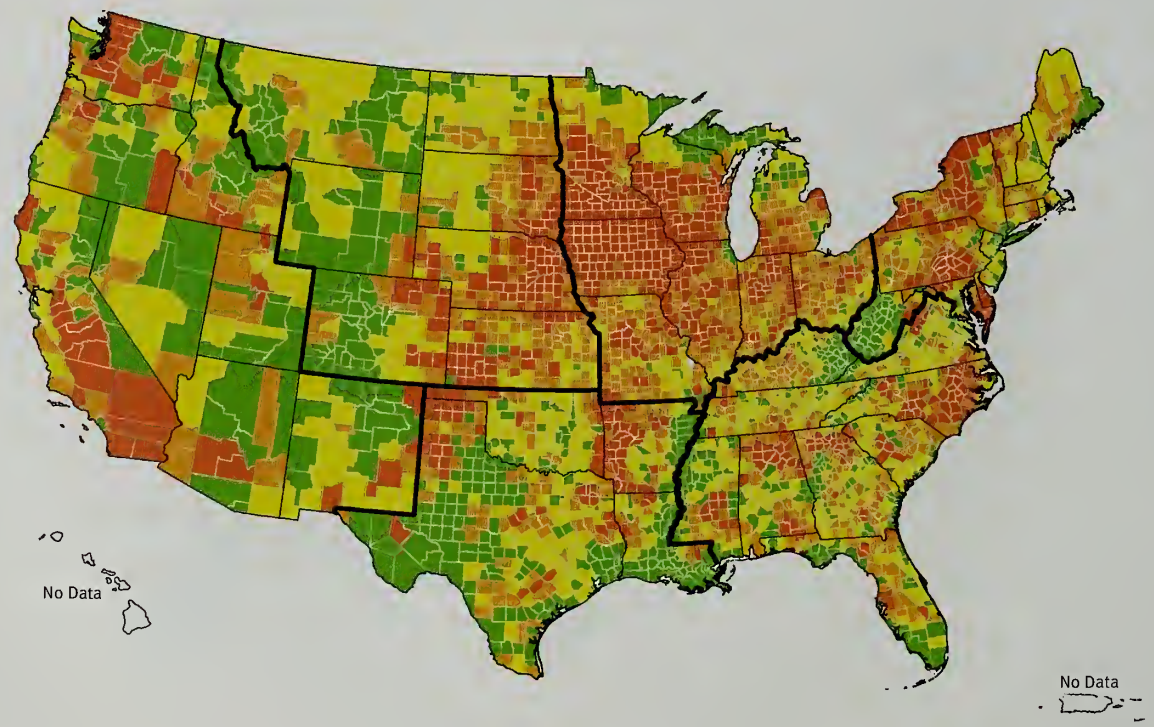
Confined livestock operations in the Midwest tend to use available manure to reduce or replace the need for commercial fertilizer on crop acres. In the Southeast and West, manure often is not managed agronomically. This may be due to smaller farm sizes; the lack of a feed production component in the operation; producer unawareness of agronomic uses of manure; or producer concerns about manure nutrient variability, equipment needs for spreading manure, or production practices that are incompatible with manure spreading.

County Ranking of Number of Animal Units

LEGEND

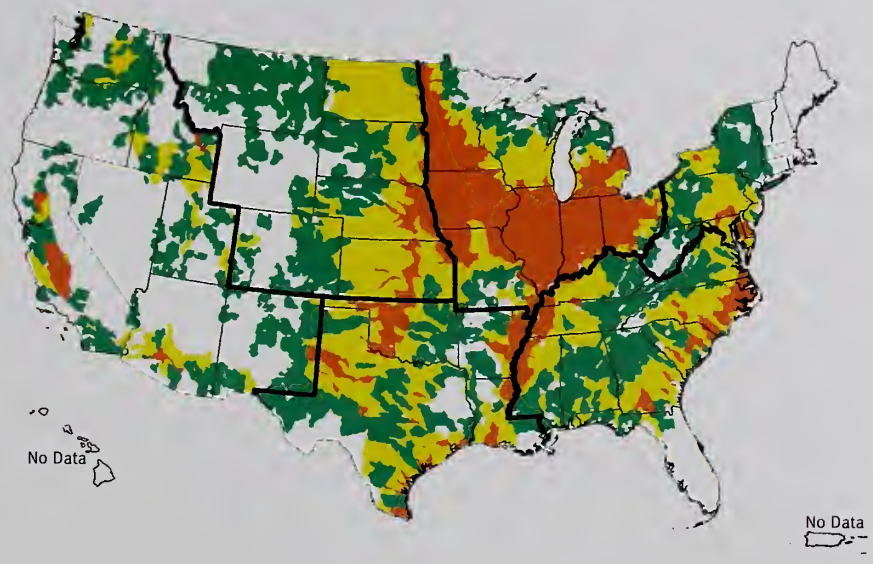
- Highest Quartile
- Second Quartile
- Third Quartile
- Lowest Quartile

Source:
USDA/NRCS, based on Economic Research Service, analysis of Census of Agriculture data, #SMW.1612, 1992



These graphics reflect the amounts of applied nitrogen and phosphate fertilizers that are not taken up by the harvested crop and, as such, may be available for loss to the environment. This does not imply that the materials actually move from the field, however. Both materials may be immobilized in the soil or managed in some other way by producers to reduce the potential for loss to the environment. Whereas nitrogen is highly mobile, phosphorus may build up in soils. But both can move from farm fields into surface water and groundwater, sometimes causing significant environmental impacts.

Nitrogen



Average Pounds per Acre

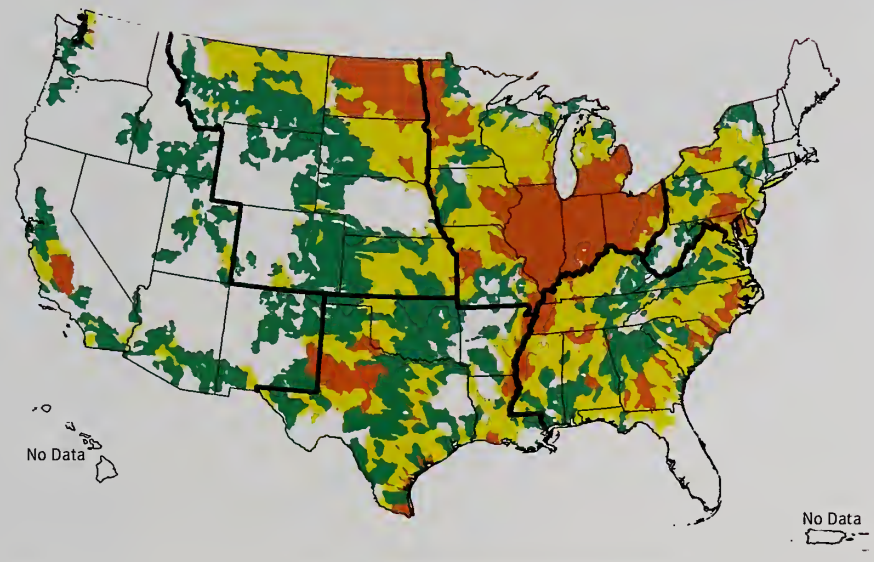
LEGEND

- > 8.7
- 2.1 – 8.7
- > 0 – 2.1
- Greater than 95% Federal land or no acreage in the 7 crops or value equal to zero.

NOTE:
Corn, soybeans, wheat, cotton, barley, sorghum and rice, using average yield over 1988 to 1992.

Source:
USDA/NRCS, #SMW.1554, 1992

Phosphate



Average Pounds per Acre

LEGEND

- > 1.75
- 0.3 – 1.75
- > 0 – 0.3
- Greater than 95% Federal land or no acreage in the 7 crops or value equal to zero.

NOTE:
Corn, soybeans, wheat, cotton, barley, sorghum and rice, using average yield over 1988 to 1992.

Source:
USDA/NRCS, #SMW.1555, 1992

Too Much of a Good Thing: The Hypoxic Zone

The hypoxic zone: It's in the Gulf of Mexico, just off the coast of Louisiana and Texas. Covering 6,000 square miles near where the Mississippi and Atchafalaya Rivers flow into the Gulf, it earns its name because, during summer, there is not enough oxygen in the water to support normal populations of fish and shellfish.

Our story starts in the Upper Mississippi River Basin, where nitrogen from fertilizers, animal manure, decaying plants, municipal and domestic wastes, and atmospheric deposition enter the river system. A certain level of nutrients in the freshwater entering the Gulf is vital to the marine food web. But excessive nutrients nourish an overgrowth, or bloom, of algae. When the algae die, they drop to the bottom and decompose. This decomposition uses much of the oxygen in the water, leaving too little to sustain organisms that live along the sea floor. Lack of oxygen kills fish, shellfish, and other bottom-dwellers and causes others to move out of the zone in search of food and oxygen.

The hypoxic zone is not only an environmental problem but also an economic one. Marine fisheries contribute more than $1 billion a year to Louisiana's economy. The fisheries are important both commercially and for recreation. But the solution is out of Louisiana's hands.

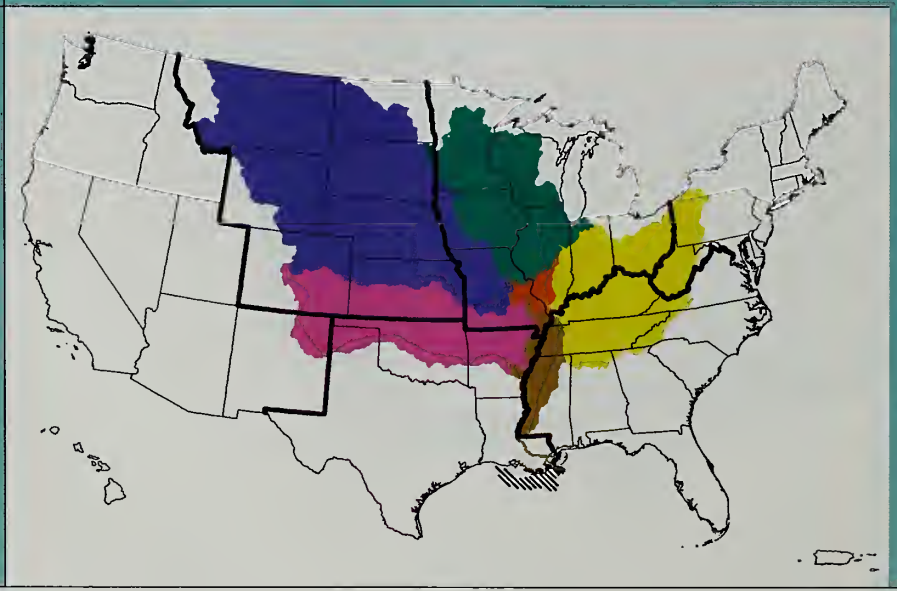
Compounding the problem is that the links between nutrient loading a thousand miles upstream and the hypoxic zone are not apparent. But the average annual nitrate-nitrogen concentration in the Mississippi River has doubled since 1950, and runoff from farmland is considered the main source.

If there is uncertainty about how to apportion responsibility for hypoxia in the Gulf, there is also uncertainty about how to deal with the problem. But as Bob Perciasepe, Assistant Administrator, Office of Water, U.S. Environmental Protection Agency, says, "The smart thing is to begin to take common-sense actions while we improve our scientific knowledge."

To that end, the Gulf of Mexico Program office is advocating a voluntary, consensus-based approach that identifies key scientific issues to be resolved while building on existing conservation efforts. Specific steps now being taken include:

- Encouraging "win-win" voluntary actions, which prevent or reduce the loss or discharge of nutrients into local waterways.
- Targeting available public funds and building on existing local, state, and Federal programs.
- Building partnerships among public and private stakeholders up and down the watershed.
- Continuing to improve our understanding of the scientific, technical, and economic aspects of the problem.
- Building an inventory of nutrient-reduction work already underway in the basin.
- Monitoring the hypoxic zone to measure and report changes in nutrient loads and the zone's extent.

Nitrogen Flux to the Gulf of Mexico from the Interior Basins



Percent by Basin of Nitrogen Flux to the Gulf of Mexico

LEGEND

- 31% Upper Mississippi
- 23% Lower Mississippi
- 22% Ohio
- 11% Missouri
- 8% Central Mississippi
- 6% White/Arkansas
- Bottom Water Hypoxia Area

Source:
USDA/NRCS, based on data from R.B. Alexander, R.A. Smith, and G.E. Schwartz (USGS), and N.N. Rabalais, R.E. Turner and W.J. Wiseman, Jr. (Louisiana Universities Marine Consortium) #RWH.1606, 1996

Since 1979, the agricultural sector has accounted for about 80 percent of all pesticide use each year. Some crops, such as cotton, are pesticide-intensive. Others, such as wheat, are not. Pesticides may contaminate water by leaching through the soil profile or by running off the field surface into nearby water bodies. Many of the same factors affect leaching and runoff potential, and some areas have high potential for both pathways. But distinctions are also apparent. For example, pesticide runoff potential is greater in the Midwest, while leaching potential is greater in the humid Southeast.

Developments such as integrated pest management, biotechnology, improved pesticide and nutrient management planning, and livestock manure management systems all work to reduce the potential for agriculture to impair the Nation's water resources. Agriculture also contributes to water quality improvement through such conservation measures as buffer strips, grassed waterways, and wetland and riparian area restoration, among others.

Nutrient Management Systems Reduce Environmental Risk

Loss of nutrients from farm fields and livestock operations can be reduced substantially by using nutrient management systems tailored to the enterprise and to the soil and climatic conditions. Federal, state, and local governments and industries in association with farmers and ranchers have established programs to test the effectiveness of nutrient management systems. Among these are the U.S. Department of Agriculture's Management System Evaluation Areas (MSEA), Hydrologic Unit Areas (HUA), and Demonstration projects (DPs). The 6 MSEAs apply promising research results to improve crop and livestock management systems. The 74 HUAs focus on remediating documented water quality problems through educational, technical, and financial assistance. Sixteen DPs, located in broad areas of actual or potential water quality impairment, demonstrate innovative practices at specific sites, and use educational efforts to accelerate broad producer adoption of new practices.

Between 1991 and 1994, USDA evaluated 16 HUA and DP water quality projects for progress in improving and protecting water quality. The projects reported substantial producer adoption of conservation practices and management improvements. At least 134 different practices were identified in the study units, ranging from structural practices, such as vegetative filter strips and constructed wetlands to reduce nutrient and sediment delivery to streams, to management practices, such as integrated crop management, improved fertilizer timing and application, and use of soil nitrogen tests. The most widely adopted practices were nutrient management, conservation cropping, cover or green manure crops, conservation tillage, and animal manure management.

Considerable improvement in agrichemical management was evident in each of the projects. For example, in Delaware (Inland Bays), farmers adopted nutrient management practices on 44,000 acres, reducing nitrogen applications by 2,600 tons and phosphorus applications by 2,100 tons. In Michigan, 18 farm members of the Sycamore Creek Crop Management Association reduced fertilizer inputs by 65 tons, pesticide inputs by 1,500 pounds, and input costs by $18,000 in a single year. Across the 16 projects, annual nitrogen application rates were reduced by 14 to 129 pounds per acre; phosphorus applications were reduced by 3 to 106 pounds per acre. As of 1994, total annual reductions were 22.3 million pounds of nitrogen and 10.3 million pounds of phosphorus. The cumulative work undertaken through these various research and demonstration efforts has improved knowledge about nutrient transport and fate and mechanisms to reduce environmental impacts from nutrient use.

Pesticide Runoff and Leaching Potential for Field Crop Production

Average Loss

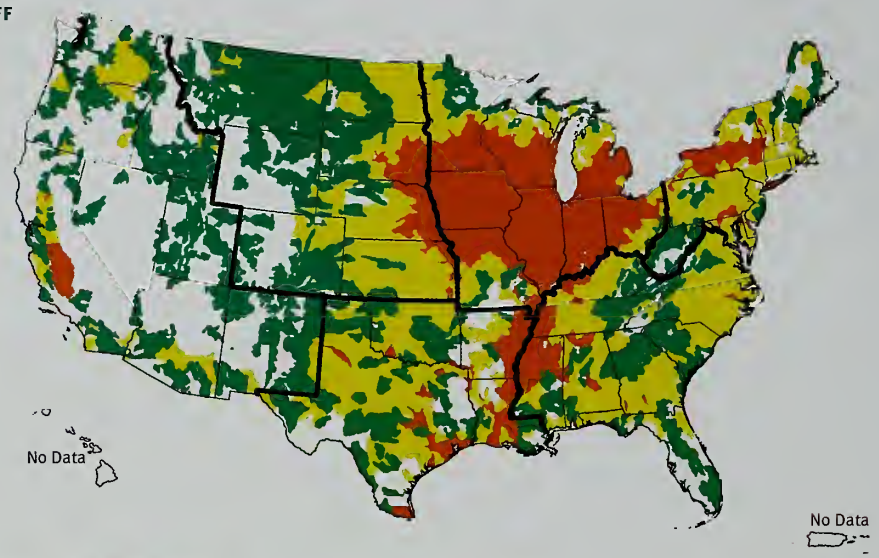
LEGEND

- High
- Medium
- Low
- Greater than 95% Federal land or no acreage in the 13 crops or value equal to zero.

NOTE:
Includes dissolved and adsorbed pesticides.

Source:
USDA/NRCS based on data from D.W. Goss, Texas Agricultural Experiment Station, #SMW.1662, 1996.

Runoff



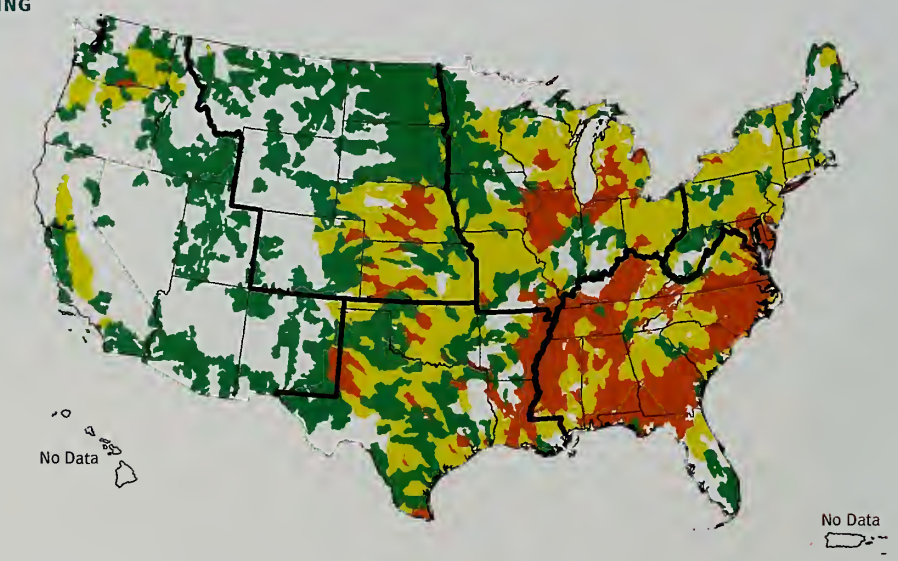
Average Loss

LEGEND

- High
- Medium
- Low
- Greater than 95% Federal land or no acreage in the 13 crops or value equal to zero.

Source:
USDA/NRCS based on data from D.W. Goss, Texas Agricultural Experiment Station, #SMW.1663, 1996.

Leaching



These graphics were obtained using a newly created database on the potential for pesticide losses from farm fields. Pesticide use in field production of barley, corn, cotton, oats, peanuts, potatoes, rice, sorghum, soybeans, beets, sunflowers, tobacco, and wheat was evaluated by watershed and averaged over all nonfederal land. Pesticide losses due to runoff and leaching were simulated using the process model GLEAMS and national data on land use, chemical use, soils, and climate. Such information can be key in identifying and prioritizing needed information and skills for farmers and resource managers to improve pesticide management programs and thus reduce the potential for loss of pesticides from farm fields.

Managing Environmental Risk from Pesticide Use

Loss of agricultural chemicals from farm fields can be reduced substantially by using farm management practices tailored to specific pest problems as well as soil, crop, and climatic conditions. The potential for reducing environmental risk through the adoption of better farm management practices is illustrated for two areas of the country where pesticide use is high–the Iowa Cedar River Basin and the Lower Illinois River Basin. A simulation model was used to estimate the potential risk to fish caused by chemicals leaving 1,400 representative farm fields scattered throughout the two basins. Actual chemical use and farm practices, such as tillage and pesticide application rates, were evaluated. Annual pesticide losses to surface runoff (including drainage and other subsurface contributions to surface water) were converted into a pesticide risk score for each field. An average pesticide risk score was calculated for each of the 28 watersheds in the two river basins. A relatively high risk score is only an indicator of the potential for pesticide impacts on water quality; monitoring is required to identify actual problem areas.

Average pesticide risk scores for 14 of the 28 watersheds indicated the potential for a relatively high risk of water resource impairment under existing farm management and chemical use practices. Three alternative management practices were simulated using the model:

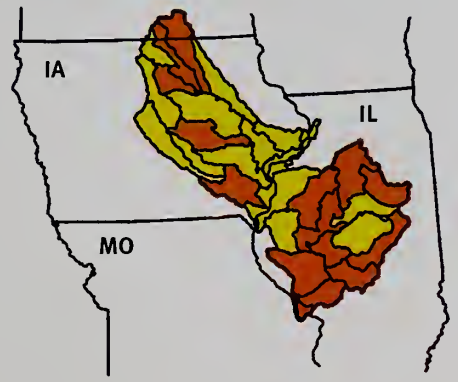
- Pesticide banding (applying pesticide in the crop rows but not between the rows).
- Use of conservation tillage (which reduces offsite movement of soil and water).
- Reduced pesticide application rates.

The simulation model predicted that risk to fish would be reduced 77 percent overall. The three watersheds with scores still in the relatively high-risk range showed a risk reduction of 65 percent.

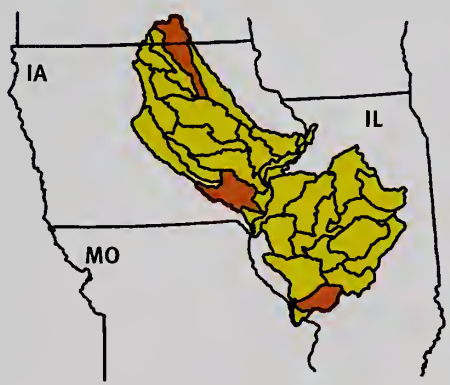
Even greater reductions in environmental risk could be expected in priority watersheds where pesticide management assistance was identified as a critical need. Chemical substitutions, crop rotations, scouting, spot treatments, postemergent application instead of preemergent application, incorporation of pesticides into the soil during application, and use of grassed waterways and buffer strips are among the management strategies not included in the simulation exercise that could be part of comprehensive farm management plans.

Potential Environmental Risk from Pesticide Use

Under Current Farm Management Practices



After Simulating Adoption of Alternative Farm Management Practices



Risk to Fish from Concentration of Pesticides in Water Leaving Farm Fields.

LEGEND

- Relatively high risk
- Relatively low risk

Source:
USDA/NRCS, #SMW.1620 & 1621, 1996

Understanding Agricultural Water Quality Problems

The U.S. Geological Survey's National Water Quality Assessment (NAWQA) program provides consistent, comparable information on water resources through studies in 60 important river basins and aquifers nationwide. These 60 study units account for about half of the land area of the 48 states and 60 to 70 percent of its water use and population served by public water supply. The data are building blocks for understanding regional differences in physical, chemical, and biological characteristics of the Nation's groundwater and surface water and for understanding relationships between and among natural factors, human activities, and water quality conditions. NAWQA findings reveal that water resource vulnerability to contamination by nitrogen and pesticides is complex and controlled by a variety of natural and land use factors. What has NAWQA found with respect to agriculture? Following are selected highlights:

Commercial fertilizers, animal manure, and atmospheric deposition are the primary nonpoint sources of nitrate in surface water and groundwater. Areas with well-drained soils and high nitrogen inputs appear to have the highest risk for high nitrate levels in groundwater. Commercial fertilizers are the dominant nonpoint source in the western, central, and southeastern United States, and atmospheric deposition is the dominant nonpoint source in the Northeast. The proportion of nonpoint to point sources of nitrogen varies from watershed to watershed. Nonpoint nitrogen sources account for more than half the nitrogen load in 90 percent of the studied watersheds, although regional variations are evident. Point sources are often a major source near large urban areas. Streams near large cities often receive a large part (up to 77 percent) of their nitrogen from point sources, such as sewage treatment plants.

Land use was the primary factor influencing instream nutrient concentrations in the eastern Wisconsin and part of Michigan's Upper Peninsula study unit. Nutrient concentrations in stream runoff were highest from agricultural and urban areas and lowest from forested areas.

In the Central Columbia Plateau of Washington and Idaho study unit, irrigation and agricultural fertilizers are associated with high nitrogen concentrations and high frequency of groundwater contamination, primarily in shallow groundwater. Nearly 20 percent of sampled wells in the study unit have nitrate concentrations exceeding the U.S. Environmental Protection Agency's maximum contaminant level.

Poultry and livestock manure contributes more than half the nutrient load in the Apalachicola-Chattahoochee-Flint River Basin of Georgia, Alabama, and Florida. In 1990, more than half of the total nutrient load–120,000 tons of nitrogen and 28,000 tons of phosphorus–came from poultry manure.

Pesticides from every major chemical class have been detected in groundwater. Transformation products, rather than parent compounds, were most frequently detected. Factors strongly linked with increased likelihood of pesticide occurrence in wells are high pesticide use; high recharge; and shallow, inadequately sealed, or older wells. Frequencies of pesticide detection are almost always low in low-use areas, but vary widely in areas of high use. While pesticides are commonly present in low concentrations in groundwater beneath agricultural areas, they seldom are at levels exceeding water-quality standards. Often, low rates of pesticide detection are found in high-use areas, indicating other factors affect their occurrence in groundwater (e.g., hydrogeologic factors). Frequency of pesticide detection may also be substantial in nonagricultural areas.

In an area of intense agriculture in Colorado's shallow San Luis Valley aquifer, pesticides were detected in only 5 of 35 monitor wells dispersed among 2,000 center-pivot irrigation systems over 270,000 acres. Four pesticides (metolachlor, p,p'-DDE, metribuzin, and prometon) were detected in the upper 10 feet of the saturated zone, with a maximum concentration of 0.07 microgram per liter.

In the Delmarva study unit, while pesticides used on corn and soybeans were detected, their concentrations generally did not violate Federal drinking water standards.

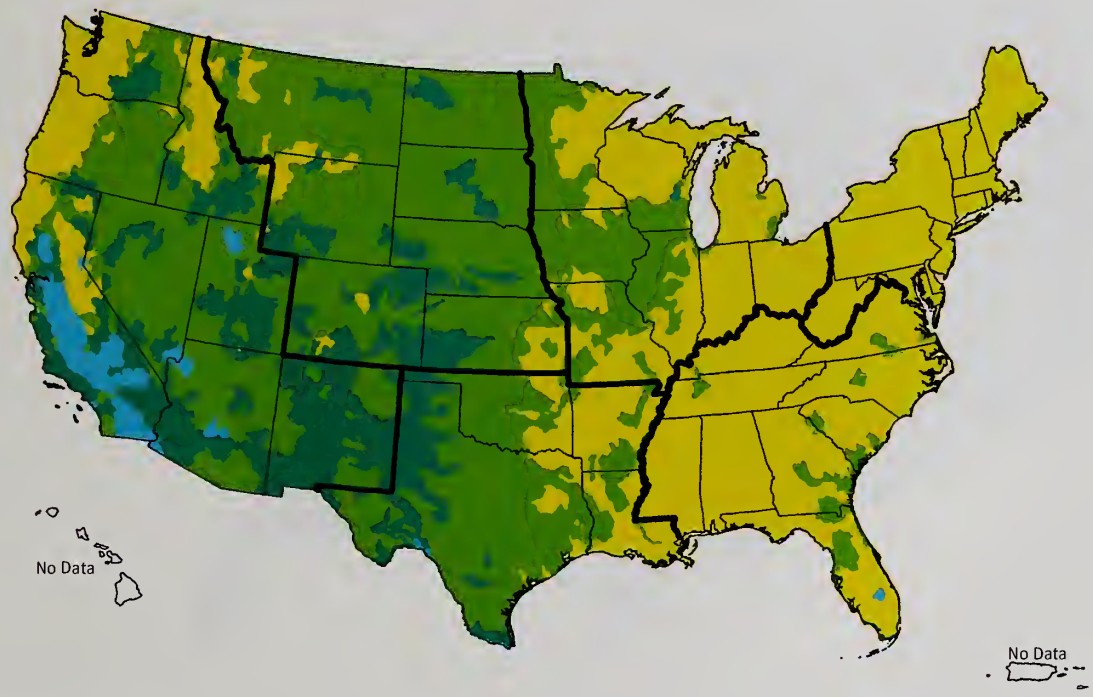
In the Georgia portion of the Apalachicola-Chattahoochee-Flint River Basin, urban watersheds contribute a variety of pesticides (herbicides, insecticides, and fungicides) applied to lawns, golf courses, parks, roadsides, swimming pools, and residential structures. Concentrations of these compounds tend to be higher and are found for a greater part of the year than in agricultural watersheds.

Private Land and Water Supply

The United States is a water-rich Nation, but water availability could be the most significant national water issue in the 21st century. Certain areas of the country, such as the Southwest, have insufficient precipitation to meet demand in an average year. These areas use more than 100 percent of their average annual precipitation and either import water from other watersheds or mine groundwater to meet annual demand. Water use conflicts have existed in those areas for decades, but the conflicts have intensified as demands have increased.

Where water demand exceeds 75 percent of available precipitation, water use conflicts are just beginning to emerge and will likely escalate if development should increase demand. Much of the East and parts of the Pacific Northwest have abundant freshwater supplies, but even these areas have experienced water use conflicts and more may arise. Water quality and quantity issues are closely linked. Actions that reduce water quantity can adversely affect water quality, just as poor water quality can reduce the amount of water able to support desired or beneficial uses.

Freshwater Consumption as a Percentage of Local Average Annual Precipitation



LEGEND

- Greater than 150%
- 100% to 150%
- 75% to 100%
- Less than 75%

Source:
USDA/NRCS and Texas Agricultural Experiment Station, Agricultural Research Service, HUMUS Project, #RWH.1576, 1996

Much of land use change and increased competition for water is driven by population growth. Even at the low rate of natural increase in the United States, total population is projected to approach 335 million by 2025. Much of the increase in recent years has occurred in areas that already depend upon more than 100 percent of their average annual precipitation.

Groundwater withdrawal at rates that exceed replenishment–groundwater mining–leads to water table declines, land subsidence, and saltwater intrusion into freshwater aquifers. The Central Valley of California is the most heavily pumped area in the United States. Because of the structure of the aquifer, land subsidence has characterized groundwater development in a large part of the valley. Once an area has subsided from overdraft, the underlying aquifer capacity cannot return to its predrawdown level.

The High Plains aquifer underlies parts of Colorado, Kansas, Nebraska, New Mexico, Oklahoma, South Dakota, Texas, and Wyoming. About 30 percent of the groundwater used

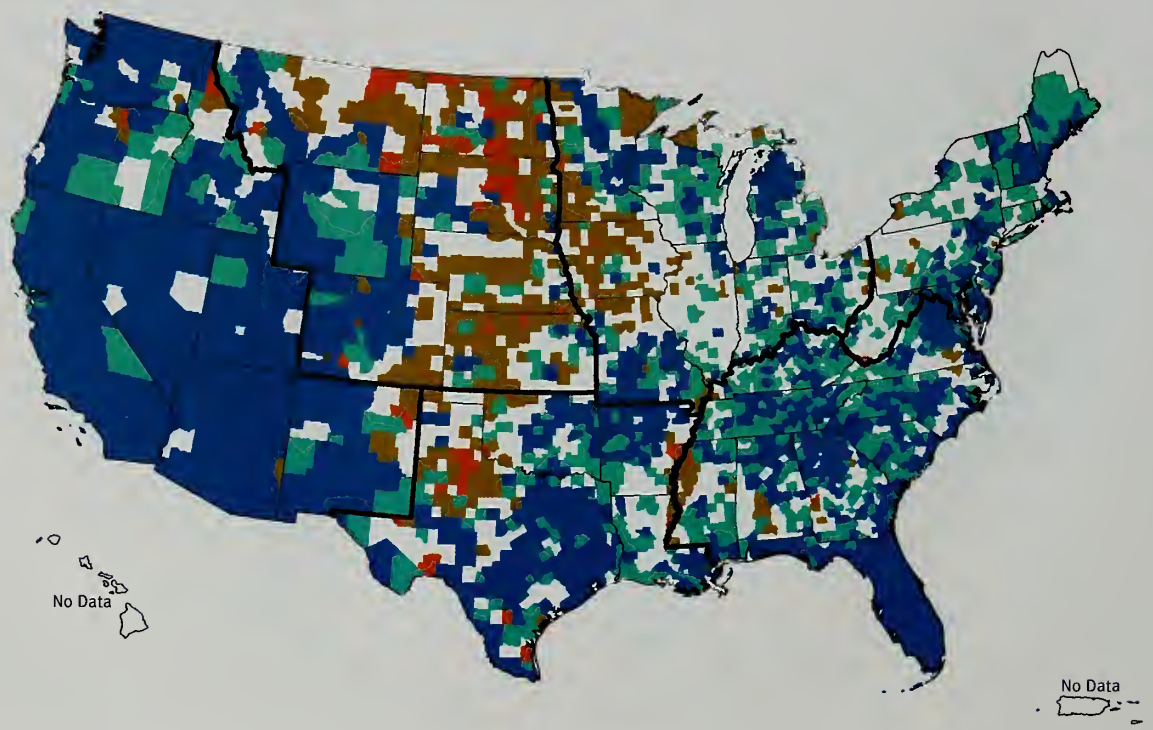
Percent Change in Total Population by County, 1970-1990

Percent Gain/Loss of Population by County

LEGEND

- Gain of more than 25%
- Gain of 10% to 25%
- Loss of 10% to 25%
- Loss of More Than 25%
- Less than 10% change

Source:
USDA/NRCS, based on 1970 and 1990 Population Census data, #RWH.1630, 1996

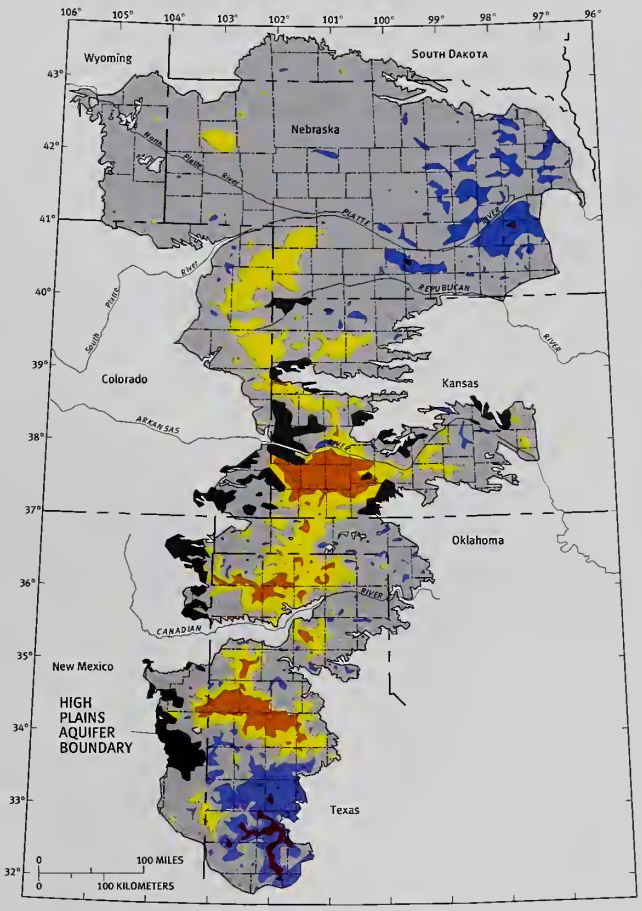


for irrigation in the United States is pumped from this aquifer. In 1990, 15.6 million acre-feet of water was withdrawn from the aquifer to irrigate approximately 14 million acres. This intense use has led to significant declines from pre-development water levels in many areas. In the central and the southern High Plains, declines have exceeded 100 feet. Smaller, less extensive declines have occurred thus far in the northern High Plains, where irrigation has been practiced for a shorter time.

Agriculture also can contribute to enhancing water supplies. Irrigators, for example, are using water more efficiently. Nationally, average water application rates have dropped 14 percent since 1970. Between 1982 and 1992, 11 million more irrigated acres were managed with water conservation systems. Cropping techniques, such as terracing and good grazing management, can increase the water available for use in a watershed. Conservation plantings can promote infiltration of rainfall, capturing more water for use by agriculture and communities.

Another form of water management–drainage–has been used extensively to extend the productive capacity of our cropland. Like irrigation systems, drainage systems require maintenance to sustain crop production.

Water-Level Change in the High Plains Aquifer, 1980-1994



Water-level Change, in Feet, 1980 to 1994

LEGEND

- Declines
  - More than 20
  - 5 to 20
  - No significant change
  - -5 to 5
- Rises
  - 5 to 20
  - More than 20
- Area of little or no saturated thickness

Source:
U.S. Geological Survey, 1994

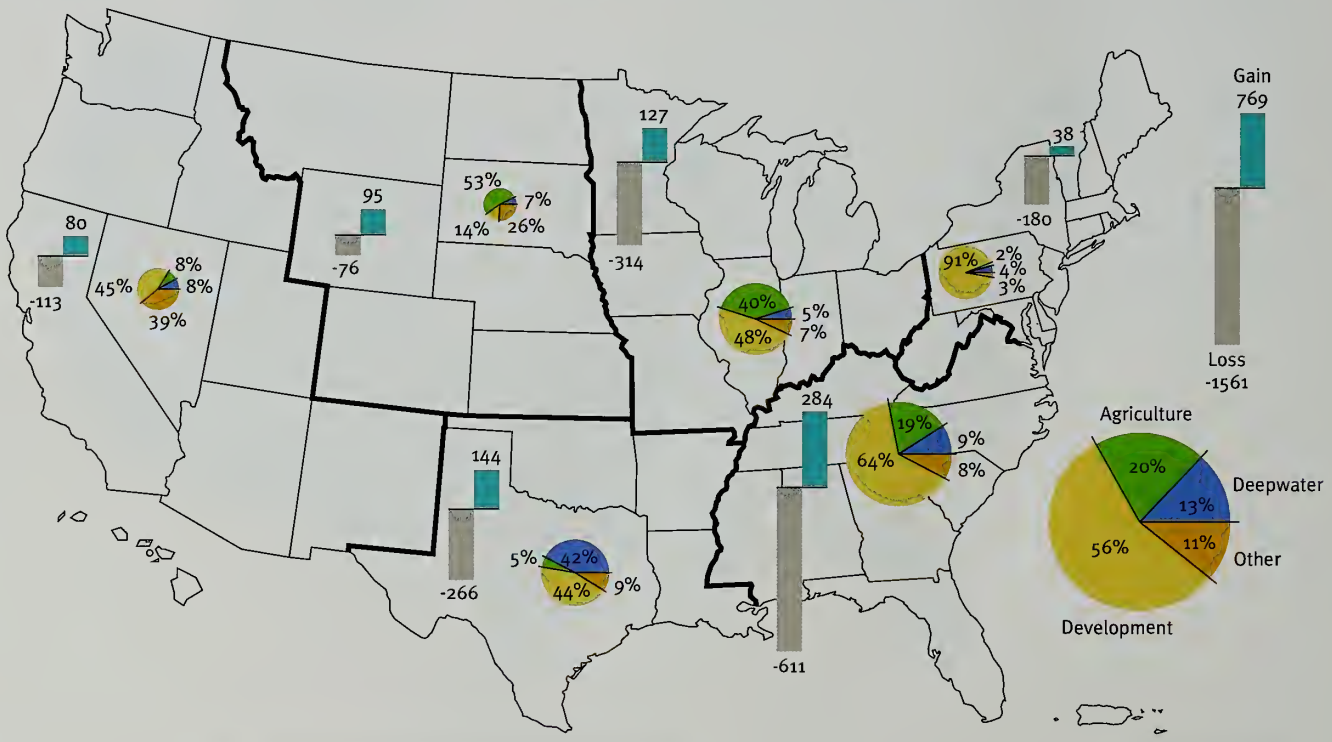
Agriculture's Contribution to Wetland Protection

Conversion of wetlands to agricultural land has declined steadily since the 1950s. In the mid-1950s, agriculture, with government encouragement, was responsible for an estimated 87 percent of wetland conversions. In contrast, between 1982 and 1992, 56.7 percent of total wetland losses were attributed to urban development, only 19.8 percent to agriculture, 12.9 percent to deepwater conversions, and 10.6 percent to miscellaneous causes.

Wetlands are an important bridge between land and water–with indistinct boundaries. Because they are so biologically rich, wetlands and adjacent upland represent an important habitat type for many wild species.

The United States has adopted a policy of "no net loss" of wetland acres, seeking to halt the diking, draining, and filling that eliminated more than half of the Nation's wetland endowment. In some highly agricultural states, such as Iowa, up to 90 percent of the wetland acreage was converted by 1970.

Changes in Wetland Acreage on Nonfederal Land, 1982 to 1992 (thousands of acres)



Wetland losses exceeded gains in nearly all regions. The Great Plains and arid regions of the West are prone to have variable precipitation patterns and what appear to be ephemeral wetlands that are distinct in some years, then difficult to observe during drier periods. The changes in wetland acreage in the Northern Plains and the West are not statistically significant and should not be interpreted as actual increases or declines in wetland acreage.

Pies Represent Loss of Wetland to Four Major Categories.

NOTE:
U.S. bar is not the same scale as regional bars.

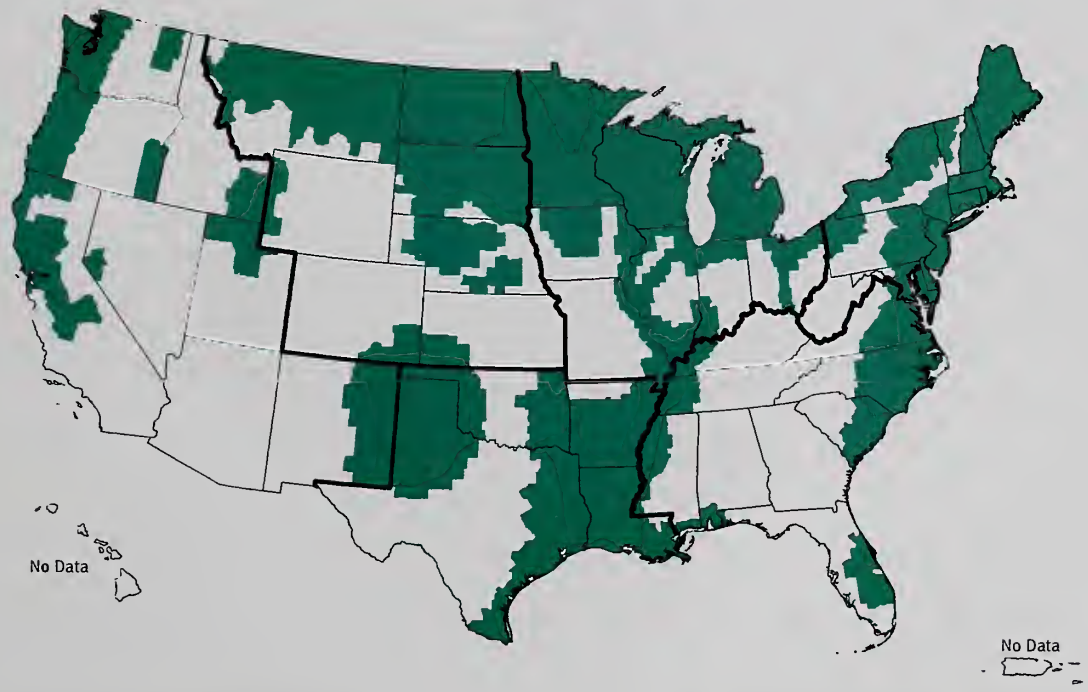
Source:
USDA/NRCS National Resources Inventory, #RWH.1712, 1992

Wetland gains come from multiple sources, reflecting wetland restoration, greater than average precipitation in some regions and identification of ephemeral wetlands. Since 1992, at least 400,000 acres of restorable wetlands and adjacent upland have been enrolled in the newly created Wetlands Reserve Program and the Emergency Wetlands Reserve Program. The Partners for Wildlife Program administered by the U.S. Fish and Wildlife Service also has been an important wetland restoration effort. The Nation may not have yet achieved its no-net-loss goal, but that target clearly is within reach, in part because of agriculture's success in protecting and restoring wetlands.

Private Land: Benefits for Wildlife

Habitat range and diversity are key factors affecting the distribution and health of wild populations, and land use is the principal factor affecting habitat. Although the total number of U.S. species is unknown, one estimate suggests there are at least 100,000 native species. Loss and fragmentation of habitat, simplification of forest and pasture ecosystems, and conversion of forested and agricultural areas to urban and suburban development all have contributed to declining wildlife populations. At the same time, habitat on private land continues to support many

Important Waterfowl Habitat Areas



While key waterfowl habitat areas have been delineated as this graphic depicts, waterfowl management is broader than this might suggest. Waterfowl populations are found in every region of the country, as residents or migrants. Management in these areas also can be important to maintaining a healthy population.

Source:
U.S. Fish and Wildlife Service, #JDV.1625, 1996

wildlife species, and considerable opportunity exists to improve and expand that habitat while respecting the rights of landowners.

Data on current trends in species populations indicate some with growing populations (colonial wading birds, such as egrets and herons, for example) and many with declining populations: certain ducks, grassland birds, forest interior birds, and salmonid fish. Some population declines are so severe that the Federal Government may formally list species as threatened or endangered, and it has. Currently, 631 species of plants and animals are listed as threatened or endangered (357 animals and 274 plants). Of the threatened and endangered species in the contiguous states, agriculture is listed as a contributing factor for about 42 percent of the species (262 species); grazing was identified for about 26 percent (161 species).

Priority wildlife conservation areas have been delineated for certain species, such as waterfowl, and similar efforts are underway for shorebirds, songbirds, and amphibians. Most species of North American waterfowl are migratory, which means that priority conservation areas are broadly dispersed. These birds depend upon wetlands–permanent and ephemeral–for breeding, wintering, and as migratory stopovers. More than 12 million ducks breed annually in U.S. wetlands, with at least half depending upon the prairie potholes in the Northern Plains. Because each area along their migratory route is seasonally important to the lifecycle of waterfowl, disruption or loss of one component can affect the viability of an entire population.

Wildlife and agriculture are not always competing interests. Indeed, many agricultural crops depend upon nature's pollinators (insects, birds, bats, etc.) to complete their life cycle. Some farmers rely on natural predators to defend their crops from insect pests. Hedgerows, shelterbelts, and filter strips, among other measures that provide soil conservation benefits, also provide much needed habitat for many wildlife species. Retirement of environmentally sensitive cropland, installation of vegetative buffer strips, and improved woodlot management can help fit wildlife into the agricultural landscape and protect soil

and water resources. A healthy agriculture is one in which wildlife–and biodiversity–flourishes.

As land is managed for diversity, landowners are also realizing new economic opportunities, such as hunting, fishing, camping, and bird-watching. Wild species support a broad range of commercial interests, such as ecotourism, that depend upon the health of the natural landscape. Wild plant and animal species contribute an estimated $200 billion to the U.S. economy annually (4.5 percent of the Gross Domestic Product). Americans spend about $18 billion annually to watch wildlife, one-third of which is associated with bird-watching. The Nation's 50 million anglers spend $24 billion on tackle, equipment, food, and lodging, among other fishing-related expenses.

Improving the State of the Land

There is much good news about the state of America's private land. America's landowners seem to be maintaining and, in many instances, improving the health of the land on millions of acres. There remain areas, however, where the state of the land is in decline and national concern is warranted. NRCS is dedicated to helping locate those situations and to working with the affected people in developing realistic, effective solutions that reverse deterioration and establish more healthy trends.

That is the mission to which the agency has been called by the American people. To meet this challenge adequately, NRCS must move beyond science and data and trends and reach out effectively to the millions of people who are intimately affected by the health of the land. That, then, becomes a matter of organization, approach, and cooperation. Only in the success of our abilities to work together, coupled with our skill in assessing the land, will we realize our public as well as individual conservation objectives.

Grant Heilman Photography

Only in the success of our abilities to work together, coupled with our skill in assessing the land, will we realize our public as well as individual conservation objectives.

Working with Land and People

Notionol oction moy be led oiid oided by government, but the soil must be conserved ultimotely by those who till the lond ond live by its products.

— Hugh Hammond Bennett
Chief, Soil Conservation Service, 1939

In ways unprecedented in human history, the United States has directed a part of its experiment in government "of the people, by the people, and for the people" to land stewardship. Since the mid-1930s, policy for the conservation of private land has involved a direct partnership among the Federal Government, states, and local communities. For six decades, conservation districts have been a testing ground for local leadership in land stewardship. Districts have provided local leadership and direction, while the partnership with a Federal agency has provided essential measures of technical excellence and consistency. This unique arrangement has proved resilient and effective. Now, we enter the 21st century, with its new pressures on land and people. Fortunately, we have considerable experience about what works and what does not.

The challenge for policymakers today is to capture a national vision that resolves into regional goals and, with further refinement, translates into local action.

We know, for example, that national leadership is essential. Without a common vision and without the information and understanding to help us work together toward our mutual objectives, the land conservation movement is like an orchestra without a conductor–many skillful musicians but not necessarily beautiful music. We also know that solutions to problems that face us in our search for a sustainable society come from the ground up. As Aldo Leopold reminded us, it is "the farmer who must weave the greater part of the American rug on which we stand."

The challenge for policymakers today is to capture a national vision that resolves into regional goals and, with further refinement, translates into local action. When viewed from the ground up, the challenge is to devise and carry out local actions adapted to specific economic, environmental, and social conditions that, when woven together, create healthy farms and ranches and combine to create healthy ecosystems, watersheds, and communities. Such healthy components are the building blocks of a sustainable society.

As the agency charged with conservation leadership in the U.S. Department of Agriculture, NRCS must focus simultaneously on both aspects of the conservation challenge: The overall vision and effective local action. Neither can succeed without the other.

To succeed, the national conservation vision for the 21st century must be consistent with the social and cultural views of the American people, individually and collectively. Those views change over time. People learn from experience, discover new scientific insights, and gain new skills and capabilities.

Clearly, the relationship between land and people has changed over the course of our history, and each new change seems to follow more rapidly on the heels of the one before. We can expect future change equal or more rapid in pace. We do not have all the answers today, but we can use the knowledge and skills that we have and recognize and use improvements as they come along.

Today's vision of conservation incorporates more than a desire for efficient production, a fear of pollution, or a disgust over degraded natural landscapes. It incorporates a growing understanding of the personal relationships among individuals, communities, and the natural environment. It embraces the notion that land is not simply an input to production or a pleasing vista. Instead, we are coming to recognize land as a partner: A partner we work with, just like we work with our neighbors, to achieve our individual and community goals. This view requires an acceptance of personal responsibility for the health of the land or, in Leopold's view, a land ethic:

We are coming to recognize land as a partner.

"All ethics so far evolved rest upon a single premise: that the individual is a member of a community of interdependent parts. His instincts prompt him to compete for his place in that community, but his ethics prompt him also to cooperate....The land ethic simply enlarges the boundaries of the community to include soils, waters, plants, and animals, or collectively: the land."

Thus, we have a guiding principle for a new vision in a modern era: Doing business in a new way, with landowners who are managing land under concepts that recognize the importance of sustainability, using new and rapidly changing tools and technologies. In such a fast-changing environment, conservation will require an enduring commitment by individuals, communities, corporations, and the Nation.

Developing this commitment will start with an understanding of the dynamics of land; the connections among environmental quality, economic prosperity, and quality of life; and identification of the means to achieve these interdependent goals. To develop such understandings will require a collaborative effort that brings all of the information, skills, history, and knowledge of people and organizations together. NRCS has organized itself to facilitate these collaborative efforts, focusing on locally led partnerships as a primary objective.

It is hard to overstate the importance of effective, locally based action in achieving our national goals for conservation in America. An old cliché suggests that we "think globally and act locally." Such thinking can only be statistical, according to author Wendell Berry. "Look at one of those photographs of half the Earth taken from outer space and see if you can recognize your neighborhood," Berry suggests. "If you want to see where you are, you will have to get out of your spaceship, out of your car, off your horse, and walk over the ground."

Berry goes on: "If we could think locally, we would take far better care of things than we do now. The right local questions and answers will be the right global ones. The Amish ques-

Partnership Profile: Coastal America

Coastal America integrates the expertise and resources of 12 Federal agencies with state and local agencies, tribal governments, and the private sector to address environmental problems along the Nation's coasts. Coastal America's Federal partners include the U.S. Departments of Agriculture, Defense, Army, Navy, Air Force, Commerce, Energy, Housing and Urban Development, Interior, and Transportation; the U.S. Environmental Protection Agency; and the Executive Office of the President.

More than half the U.S. population resides in the narrow band of coastal counties, where densities are more than four times the national average and increasing rapidly. Human activities in these and inland areas with watersheds that reach the coast profoundly affect coastal ecosystems and jeopardize the economic value of coastal tourism, fisheries, property values, and public health and safety. In 1992, the partnership identified habitat loss and degradation, nonpoint-source pollution, and contaminated sediments as primary issues, but its focus has broadened over the years as projects succeeded.

A central goal is to determine how various authorities and programs can be integrated to protect and restore the Nation's coastal resources while supporting valuable economic activities. Like the best partnerships, Coastal America brings together the partnership agencies and stakeholders to garner innovative ideas and to identify the fine line that balances competing interests. The Federal partners and nonfederal stakeholders also combine authorities and pool resources to accomplish objectives that no one agency could accomplish alone.

Coastal America is as much a process as a program. It is a national partnership, but objectives are set at the regional level and incorporated into collaborative plans. Projects are then implemented at the local level in direct response to the problems and priorities identified there.

Since 1992, Coastal America has initiated 180 projects in 26 states, two territories, and the District of Columbia; the projects are being conducted in collaboration with more than 300 nonfederal partners. Projects typically strive to achieve sustainable development and to supply "multiplier benefits." For example, maintenance dredging of a Federal navigation channel in California's Petaluma River enhances water access and provides clean dredged material for restoration of tidal wetlands in a region that has lost more than 98 percent of its original wetlands. Once completed, the current projects will have contributed to habitat for more than 20 endangered species, restored in excess of 100,000 acres of wetlands, reestablished hundreds of miles of anadromous fish habitat, instituted best management practices on farms in more than 50 watersheds, improved local economies, and generated numerous public educational products.

Coastal America is often cited as a model for other partnerships.

tion, 'What will this do to our community,' tends toward the right answer for the world," as does the question posed by Native Americans, "What will it do for seven generations hence?"

A Renewed National Commitment

As we approach the next millennium, our Nation is in the process of reassessing the importance of long-standing institutions. In a major restructuring of the U.S. Department of Agriculture and its purposes, we have reaffirmed our commitment to a national effort for conservation on private land. The Soil Conservation Service has been renamed the Natural Resources Conservation Service. The mission of the agency has been broadened, but NRCS retains its historic role of promoting the sustainable use of private land by providing information, delivering technical assistance, and encouraging voluntary adoption of conservation measures by private landowners. The new name formally acknowledges the long-held recognition that conservation is more than preventing soil erosion, that soil or water or other natural resources cannot be managed in isolation from one another.

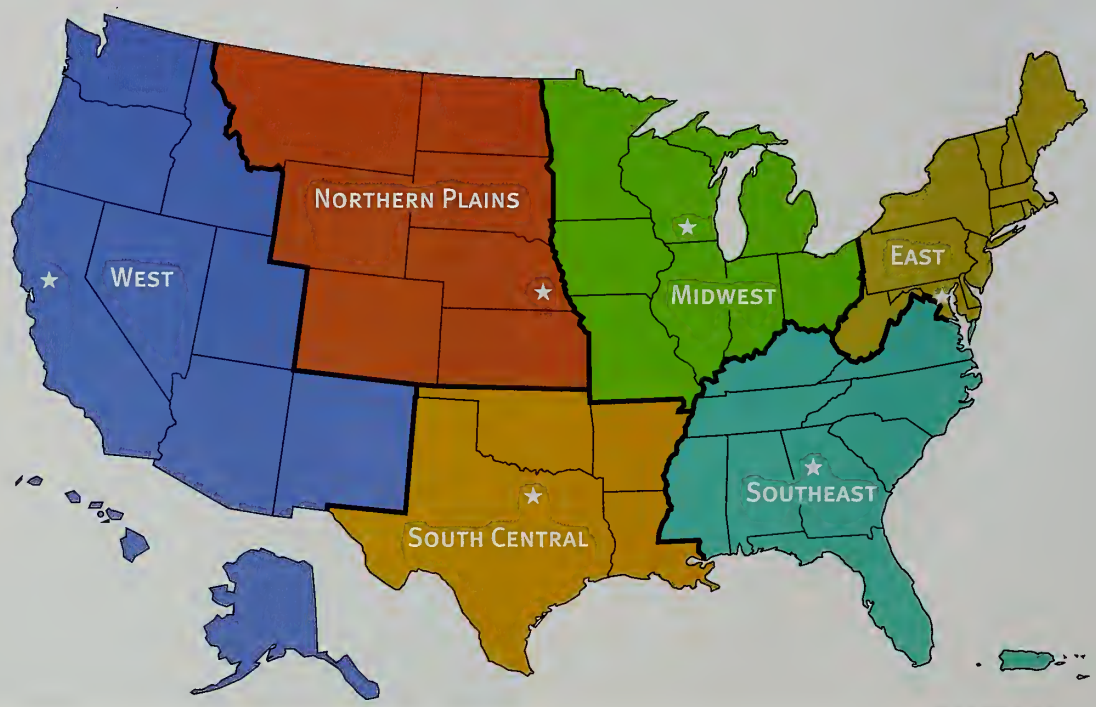
To carry out this expanded mission, NRCS has changed its organization to ensure greater regional and local emphasis.

Natural Resources Conservation Service Regions

★ Regional Office Locations

East: Beltsville, Maryland
Midwest: Madison, Wisconsin
Southeast: Atlanta, Georgia
South Central: Fort Worth, Texas
Northern Plains: Lincoln, Nebraska
West: Sacramento, California

Source:
USDA/NRCS, #RWH.1797, 1996



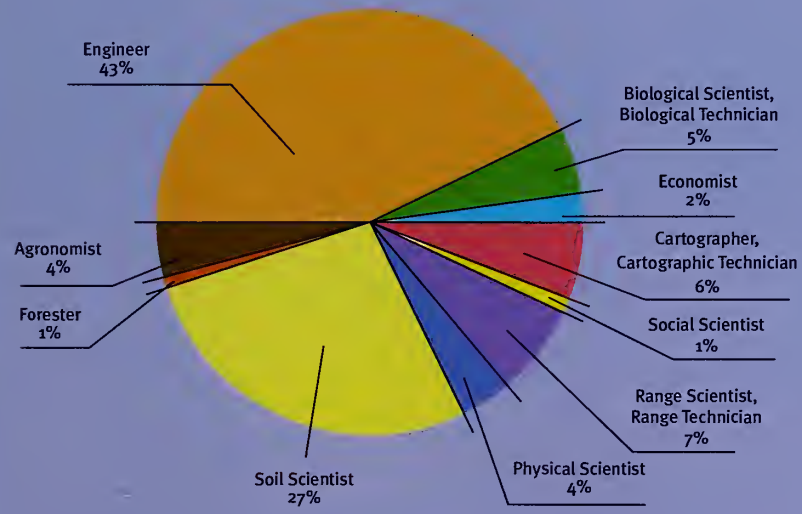
NRCS Employees: On the Ground and Working

Hugh Hammond Bennett's vision of the Soil Erosion Service was one of scientists and technicians working directly with landowners to correct existing problems and prevent new ones from arising. Even as the agency has evolved–into first the Soil Conservation Service and more recently the Natural Resources Conservation Service–it has retained Bennett's vision of a hands-on, field-oriented agency.

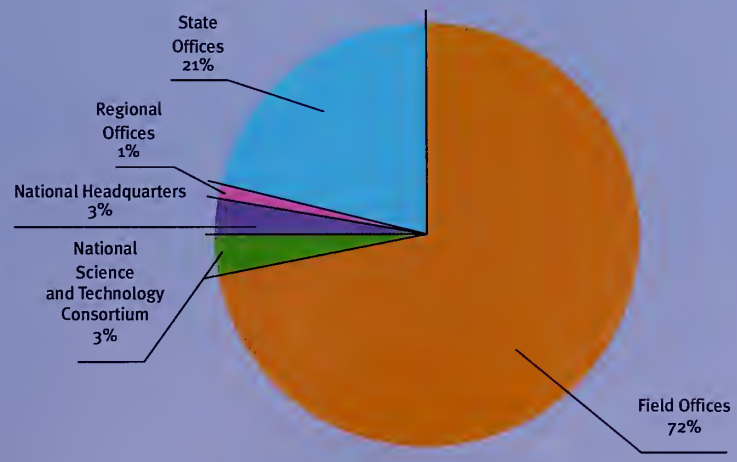
Nearly half of today's multidisciplinary workforce is classified in a job series called soil conservationist–a job that requires formal education in soils and other physical or biological sciences. Most of the agency's soil conservationists work in county or multicounty offices helping individual landowners and local organizations and governments identify and address natural resource issues and problems. Nearly 30 percent of the agency's workforce provide scientific and technical support, directly or indirectly, to the field staff.

Nearly three-fourths of NRCS employees are stationed in some 2,500 field offices–in nearly every county–across the Nation. The rest are in administrative and technical support roles in national headquarters, institutes, and centers that foster development and transfer of science and technology and in regional and state offices.

Science and Technology Occupations in NRCS, August 1996



Where do NRCS Employees Work? August 1996



The 1996 farm bill–the Federal Agriculture Improvement and Reform Act–reinforced those actions by encouraging a shift in focus away from Washington, DC, toward regional and local leadership. In addition, the 1996 Act emphasizes the need to augment the traditional goals of conservation–supporting and embracing the production of commodities–with a new focus on the production of environmental commodities that are of increasing interest and value to all Americans.

The new organization moves many of the functions formerly centered in the national headquarters to six new regional offices. Within each region, where natural resource, social, economic, and cultural conditions are similar, the national vision of productive, sustainable communities in harmony with a healthy land can be shaped to the realities of that region. Resource assessment and strategic planning activities can be better focused, continuous, and more responsive to local conditions. This will ensure that rapidly changing situations on the land are detected sooner and included in rapidly available assessments that can be shared.

Communication can occur vertically and horizontally so that individuals and communities can have broad program guidance while innovative, local problem-solving strategies are recognized and shared quickly with others. Information and resources, including financial resources, from public agencies and private

The 1996 Farm Bill's Commitment to Conservation

The 1996 Farm Bill, passed by Congress and signed into law by the President on April 4, 1996, has been heralded as the most progressive environmental farm bill to date. Conservation provisions in the legislation will affect farmers well into the next century. The new provisions build on the conservation gains made by landowners over the past decade. They simplify existing programs and create new programs to address high-priority environmental protection goals. The key provisions:

- Environmental Quality Incentives Program consolidates four existing conservation programs (Great Plains Conservation Program, Agricultural Conservation Program, Water Quality Incentives Program, and Colorado River Basin Salinity Control Program) and directs cost-sharing and technical assistance to locally identified conservation priority areas. Half of EQIP funds are dedicated to livestock-related conservation problems.
- Wetlands Reserve Program and Conservation Reserve Program are extended through 2002.
- Farmland Protection Program provides assistance to states that have farmland protection programs to purchase conservation easements.
- Swampbuster and wetlands provisions from the 1985 and 1990 Farm Bills are modified to provide farmers with more flexibility to meet wetland conservation requirements.
- Wildlife Habitat Incentives Program helps landowners improve wildlife habitat on private land.
- Flood Risk Reduction Program provides incentives to move farming operations off frequently flooded land.
- Emergency Watershed Protection Program allows purchase of floodplain easements.
- Conservation of Private Grazing Land Initiative offers landowners technical and educational assistance on private grazing land.
- National Natural Resources Conservation Foundation is created as a nonprofit corporation to foster conservation research, education, and demonstration projects.
- Conservation Farm Option allows farmers with market transition contracts to consolidate CRP, WRP, and EQIP payments annually, under a 10-year contract, in return for adoption of a conservation farm plan.
- State Technical Committee membership is broadened to include agricultural producers and others with conservation expertise.

organizations can be assembled through a partnership approach that reduces duplication and increases value for all.

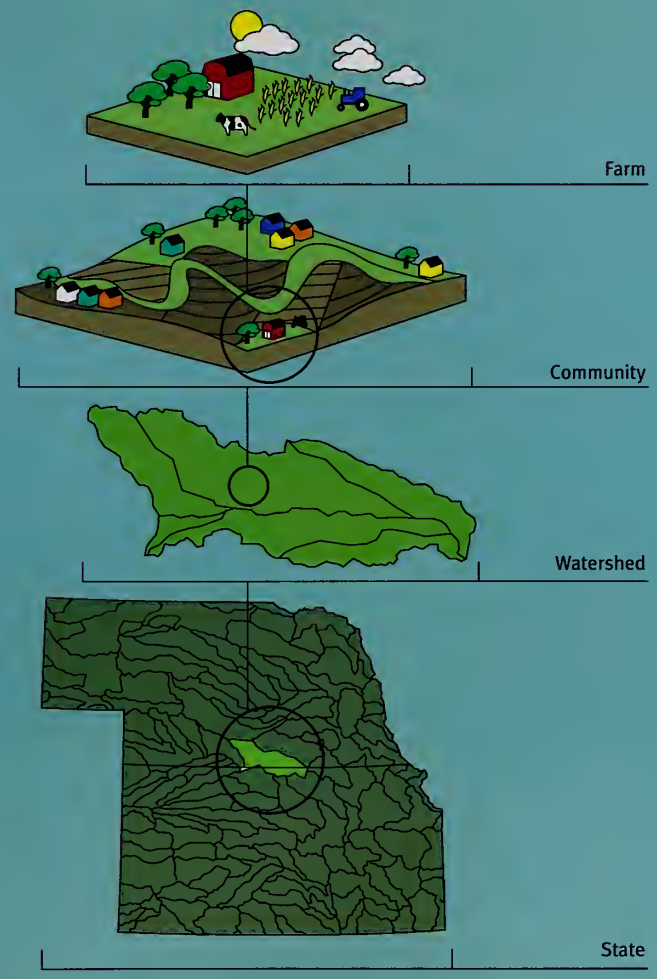
The focal point for locally led assistance and technical help for individual landowners is the network of NRCS field offices maintained at nearly 2,500 locations across the country. Those offices provide the point of contact with local conservation districts as well as related community groups and units of government. Field-office staff members, working with conservation district staff members and other partners, assist in developing individual conservation plans and applying soil and water conservation measures on all private land–agricultural and nonagricultural. They work with community groups in developing locally led approaches to conservation at the county, watershed, or other geographic level. Local NRCS offices are supported by multicounty and state office staffs featuring technical specialists, such as soil scientists, agronomists, biologists, engineers, sociologists, and economists. Their expertise can be used to address difficult problems, both new and old.

Locally Led Conservation

NRCS has reaffirmed its 60-year commitment to locally led conservation as one of the most effective ways to help individual landowners and communities achieve their conservation goals through a voluntary approach to land stewardship. The land area in question will vary, depending upon the goals and desires of the landowner and community interests involved, but typically, that area will be defined by natural boundaries, such as a landscape or watershed.

Effective, locally led conservation offers an opportunity to bring together–under the leadership of local conservation districts–all of the people who care about their "home place." Included will be the landowners themselves, as well as all others

Relationships of Site-Specific Management to Broader Ecological Areas



Source:
Adapted from U.S. Environmental Protection Agency, 1993

whose lives and futures might affect or be affected by what happens on the land. Locally led conservation brings downstream neighbors affected by what happens in their home place into the process of developing effective, voluntary approaches to conservation.

Locally led conservation brings people together to assess their home place, to set goals, and to identify programs and other resources that can be used to create the home place they want. People working together as neighbors find solutions to common problems and agree on ways to implement those solutions.

Locally led conservation means neighbors working together as the foundation for effective conservation, facilitating effective communication, achieving mutual understanding, and forging partnerships. Its success is based on finding common ground and developing shared conservation goals and shared responsibility for achieving those goals. Neighbors–farmers, ranchers, rural and urban residents alike–take responsibility for their share of conservation.

Locally led conservation brings people together to assess their home place, to set goals, and to identify programs and other resources that can be used to create the home place they want.

Locally led conservation depends upon the creativity of those who participate to find ways of using all the resources available throughout the community, from both governmental and nongovernmental sources. All U.S. Department of Agriculture programs become tools, along with other Federal, state, and local government and private-sector programs, to be used in an integrated fashion to achieve common goals.

Those who participate in locally led conservation efforts often include people and groups who value the land for very different reasons and in very different ways. As they come together to understand the land in a particular area, they are often able to focus far more clearly on the shared visions they may have for their home place. Where natural resource conditions and needs can be assessed, goals defined, opportunities and constraints identified, and responsibilities clarified, plans of action can emerge that have a good chance to succeed because the plan is rooted in a shared vision and responsibility.

The NRCS role in locally led conservation varies according to what a community needs. In addition to serving as a catalyst for locally led conservation efforts, the agency's role is to speak for the health of the land and the people who both work the land and depend upon it. NRCS supports, facilitates, and informs the process of locally led conservation by providing natural resource inventories and assessments, planning assistance, and technical assistance.

Informed citizens are fundamental to making informed choices. People's expectations must be consistent with what the land can provide, both in terms of agricultural commodities and environmental benefits. People need to understand their opportunities to avoid natural resource degradation or environmental pollution and to achieve their goals.

To help people understand their land and its natural resources–their home place–NRCS is working on new technologies to display and disseminate information. Computer-generated maps, for example, can illustrate where specific problems exist and the opportunities to make things better.

Emerging computer technologies can help answer all-important "what if" questions that concern residents in the local area:

- What will happen to water quality in the nearby lake or stream if farmers adopt a new form of conservation tillage?
- Will farmers and ranchers prosper using new technologies; should the cost of those technologies be shared by their neighbors?
- How often will our new park flood, and how far out will the floodwater extend?"

Computers cannot make decisions. Only people can. But computers can help. Knowing what is likely to happen is better than operating with no knowledge whatsoever.

One sure thing about locally led conservation is this: The more it is used, the better it gets. The more people work

Ohio: Low-Interest Loans for Conservation

Imagine getting a below-market-rate loan for conservation! The Ohio Environmental Protection Agency (OEPA) has been offering just such loans through its Water Pollution Control Linked Deposit Program. The loans may be approved for any practice, equipment, or management change that will have a positive effect on water quality; the farmer's interest rate is about 3 percent below the going market rate.

A participating farmer works with the NRCS district conservationist to prepare a farm plan, looking at the farm's entire resource base–soil, water, trees, livestock, wildlife, and other factors. If the plan is approved, the farmer is given a Certificate of Qualification, which he or she takes to a participating bank. The bank determines the credit worthiness; the OEPA, NRCS, and the local conservation district determine conservation worthiness.

According to Barry Cavanna, the NRCS district conservationist who coordinated the first linked deposit program in Ohio's Killbuck Basin, the most important criterion is flexibility: "We set no parameters here; if it's related to pollution control, we'll buy in." One loan paid for the manure storage, watering facilities, fencing, and other necessities for a dairy farm to convert to rotational grazing. Other loans have financed grassed waterways, barn roof gutters, manure treatment and handling facilities, erosion control practices, and milkhouse waste handling. Says Cavanna, "We're even working with one farmer to buy a semi with a tank hauler so he can haul manure from his main farm to outlying farms." In the Killbuck Basin, there have been 13 loans totaling more than $1 million.

In the Darby Creek watershed, 32 comprehensive farm plans were completed in the first 6 months of the program; 25 or 26 loans were made, totaling about $1 million, according to Wes Beery, an NRCS employee serving as agriculture coordinator for The Nature Conservancy's Darby Creek Project. OEPA has set aside $9.3 million for about 40,000 acres of priority area, a 1,000-foot band on either side of the Darby. "The loans are for the whole sweep of nonpoint-source pollution," Beery says.

Water quality coordinator Mary Ann Core says certificates have been issued for loans for more efficient pesticide sprayers, animal waste control systems, and revamping fertilizer storage areas, as well as for yield monitors on combines. The monitors, she says, are "a first step toward precision farming, so they can do more micromanagement. In the end, that will mean better placement of fertilizer and herbicide, which also ties to soil quality and fertility." One farmer has sought a loan for a global positioning system receiver to map fields for yield, weeds, and fertility levels, which would improve his application rates for pesticides and herbicides. Says Core, "I think this is great because it teams the local bank, soil and water conservation district, NRCS, and OEPA with the farmer, and the farmer is generating what he or she wants to do. And it's not a government handout; the farmer must borrow and repay the money."

Cavanna credits OEPA for being flexible and "fantastic to work with." Beery says that the involvement of everyone from bankers to farmers has been "a real education for all concerned and may have spin-off benefits greater than the individual loans and projects."

Locally Led Conservation: More Than the Sum of Its Parts

Nebraska: The Rainwater Basin Joint Venture

I went from agency to agency looking for help on wetland restoration, recreational use, erosion reduction, wildlife habitat protection, but I got different pieces from each, and couldn' t do much on my own. When all the specialists came to my place with the bioengineering team, though, it was different. In a couple of hours they got together.

Dennis Oehlschlager, Farmer, Saline County, Nebraska

The competition over land use–between farm and wetland, agriculture and waterfowl–has been intense in Nebraska's Rainwater Basin. Enter Steve Moran, a 17-year engineering veteran of the Natural Resources Conservation Service, who began the Rainwater Basin Joint Venture in 1995. Moran realized that landowners and government agencies were not really communicating. This became particularly clear in a meeting where a sister agency representative explained to some landowners that "'We need up to 18 inches of water from February through March for the migratory waterfowl'; the landowners replied, 'it's not the zero to 18 inches of water in March that bothers us, it's the 2 feet of water in August after we have our crops in. If you'll talk about stopping flood damage, erosion control, shortage of irrigation water, and help us overcome common barriers we have as landowners, we'll talk about the zero to 18 inches'." That was a powerful lesson, says Moran: "You don't talk to people about what you need, but about what they need."

Listening and discussion sessions led to landowners and agencies agreeing on common issues to be addressed. The agencies worked together to provide the resource inventories and technical assistance the landowners needed to make their own decisions and develop plans. "Now," says Moran, "we're giving new meaning to the phrase 'one-stop shopping'." The Joint Venture brings the different agency experts together as a bioengineering team, and they go to the farmers.

Dennis Oehlschlager, a farmer with 240 acres on the northwestern edge of the Rainwater Basin, had been to different agencies but could only get pieces of the picture. Says Moran, "We brought one biologist from the U.S. Fish and Wildlife Service and one from Nebraska Fish and Game, an engineer from NRCS, a resource specialist from the conservation district, and [Dennis] stood back and watched the folks put the puzzle together for him." The result: They went from initial discussions in April to project completion in August.

Oehlschlager's project involved constructing a 2.5 foot-high dike to create shallow-water habitat and control gully erosion that was depositing sediment on a neighboring pasture. Approximately 1,300 cubic yards of earth fill was used to build the dike, with the water level controlled by a pipe system designed to drop overflow water to a stable outlet structure. The construction costs were shared by the Nebraska Soil and Water Conservation Program of the Lower Big Blue Natural Resources District, the Wetlands Initiative Program of the Nebraska Game and Parks Commission, and the landowner.

Moran says that after nearly 2 years the planning process has evolved. Now, the broad range of issues are considered–habitat, flood control, irrigation water, communications. Although it takes enormous energy, according to Moran, "it's an approach that is necessary. Any benefit for wildlife is a byproduct of other practices. We have to get away from the all-or-nothing philosophy that keeps things pigeon-holed."

Farms and ranches throughout the United States produce traditional and nontraditional commodities. Dennis Oehlschlager's farm, for example, produces corn and other row crops and his restored wetland provides an important rest stop for migratory waterfowl.

New York: The Skaneateles Watershed Program

The City of Syracuse, New York, is trying to avoid filtering to keep its water supply safe and healthy. Under the Skaneateles Lake Watershed Program, Syracuse is prepared to spend $17 million over 10 years to protect water quality in Skaneateles Lake from which the city draws its water. The program will assist farmers to install pollution-preventing practices on their farms, promote land conservation programs on nonfarm land, and, in collaboration with other agencies, educate watershed residents so they can protect water quality on their own. The program, modeled after one developed for New York City, intends to reduce nonpoint-source pollution in hopes of avoiding an estimated $40 million to $50 million investment in a filtration plant. Syracuse, like New York City, has one of the few unfiltered water supplies in the country; both opted for land treatment as their preferred alternative.

Lee Neville Macbeth coordinates the Skaneateles Watershed Program for the City of Syracuse. Building public trust through outreach and education has been an important element from the outset. NRCS and conservation districts helped farmers and the city to form the original Agricultural Ad Hoc Task Force. As Macbeth says, farmer acceptance of the proposed program structure was needed to make it work.

The Watershed Agricultural Program, managed by Jeff Ten Eyck, employed a three-tiered approach, essentially a risk assessment, with the most attention paid to those farms posing the greatest threat to water quality. In the summer of 1996, preparation and implementation of tier-3 farm planning had begun for seven farms with the more serious conservation needs.

The first step was to undertake plans for dairy, sheep, beef, and crop farms as prototypes and then develop plans for the high-priority farms to get at the flow of priority pollutants–nutrients, pathogens, and sediment–to the lake. Syracuse will provide up to 100-percent cost-sharing for best management practices, such as erosion control measures, intensive rotational grazing, barnyard water management, and nutrient management. One crop farm that is adopting contour farming is expected to reduce soil erosion by some 332 tons on 240 acres.

The early agricultural emphasis was to address the pathogen pathways posing health concerns. As the program moves forward, there is increasing attention to non-agricultural land. Macbeth says the city is working with local land trusts to encourage the acquisition of conservation easements, sponsoring seminars and providing technical assistance to nonfarm landowners, and collaborating with Cornell Cooperative Extension Service to provide education to municipalities and businesses and to watershed homeowners. A consortium of smaller towns in the watershed, some of which draw their water from Skaneateles Lake, is being organized to ensure that they have access to good information.

The Watershed Agricultural Program can produce multiple benefits beyond protecting Syracuse's water supply, according to NRCS State Conservationist Rick Swenson. "If the land is kept in farming," he says, "the open land can provide aesthetic values, conserve biodiversity, and protect wildlife habitat, as well as improve water quality. More intensive agriculture or sprawl would surely make a filtration plant inevitable for Syracuse."

Ohio: The Soil and Shipping Connection

To deal with harbor sediment, you dredge, right? Nope, you try dredging avoidance, in the words of the Toledo Port Authority's John Loftus. You help farmers to reduce soil erosion on the land. This means getting the dredgers–the U.S. Army Corps of Engineers and the Port Authority–together with the people who own the land that erodes: the 4 million acres (3.2 million in crops) in the harbor's drainage basin, principally around the Maumee River and its tributaries. Fortunately, many of Ohio's farmers began adopting conservation tillage practices in the 1970s, when they joined in efforts to reduce phosphorous loading in Lake Erie–one of the causes of the lake's near-death.

Locally Led Conservation: More Than the Sum of Its Parts *continued*

It hasn't been easy. The Toledo Harbor-Maumee Basin effort has brought together agencies and people with seemingly unbridgeably different responsibilities. Once you think about possibilities, however, the connections among stakeholders are obvious. Nearly 25 percent of the 13.5 million tons of cargo shipped through the Port of Toledo each year comes from farms. Maumee Basin farmers were shipping not only their grain but also their good soil to Toledo. Preventing soil erosion reduces the dredging burden and benefits the farmers by keeping the soil on the land.

Cultural differences made communication between agencies difficult at the project's outset, but now the agencies are working together to reduce harbor sedimentation by a conservative 15 percent. According to NRCS coordinator Gary Overmier, the interagency agreement is probably unique in that part of the funding for the project–$700,000–is coming from the Army Corps of Engineers, while NRCS is providing offices, staff, and technical expertise. The Ohio Environmental Protection Agency's revolving loan fund and other agency funds also are available for certain local erosion control initiatives.

NRCS and local conservation districts have set up Sediment Reduction Committees to work with farmers on soil erosion reduction initiatives. By summer 1996, a number of conservation district projects had started, including adapting planters for conservation tillage, installing riparian corridors and windbreaks, planting grassy strips in gently sloping waterways, and holding field days to showcase new technologies and tools. The initial emphasis has been on education and demonstrations. The next phase, according to Overmier, is for NRCS to work one-on-one with farmers to develop farm resource management plans. Although the main objectives may be to reduce soil erosion in the Maumee Basin and sedimentation in Toledo Harbor, multiple benefits will result, including improved wildlife habitat and water quality enhancement.

Lake Erie continues to make a comeback. In 1992, Lake Erie anglers hauled in more than 2 million walleyed pike, up from a mere 113,000 in 1975. Sedimentation avoidance is one way to build on that success.

California: Working Together for Salmon

Its a hard concept. On the farm you plant and harvest the seed you sow, and you are responsible for it on your own place. Salmon, on the other hand, have their seeds planted in the upper watershed, but they are harvested in the ocean. It reminds us how humble we need to be in terms of how complex these systems are. The salmon fishery presents common ground and is making it easier to get people together.

Tom Schott, District Conservationist, NRCS, Ukiah, California

Tom Schott is one of hundreds of people trying to restore the salmon and steelhead fishery in the Pacific Northwest. That fishery has been decimated by a combination of human activities and natural events. Dam building, goldmining, logging, farming and ranching, and overfishing, as well as floods, drought, earthquakes, and even El Niño, have affected the salmon and their habitat. In northern California, the commercial salmon fishery has been effectively closed for nearly a decade. Since 1954, California salmon and steelhead stocks have declined by 80 percent and Central Valley dam construction has reduced the river reach available for migrating salmon and steelhead by 95 percent.

Major efforts are now under way in California, Oregon, Washington, and Idaho to reverse the fishery decline. Every aspect of land and water use is being addressed, including current activities–timber management, agriculture, and development–and problems left over from past activities. "If you don't start at the top of the mountain, you won't solve the problem," says Paula Yoon, who had previously made her living from the northern California fishery. Farmers, ranchers, and other landowners are taking part in numerous programs to improve stream values and salmon habitat.

Bob Falge, a retired sawmill worker, now a rancher, participates in the salmon recovery effort. Falge remembers: "The 1964 flood tore most vegetation off streambanks and put a lot of gravel in the streams. We had trouble getting new trees and foliage

established along the streambanks because deer and livestock ate it right off." NRCS's Schott proposed "exclusionary fencing" to account for "seasons of sensitivity." Although initially skeptical, now Falge is a convert. After the fencing, "all these little trees got started on their own in the fenced area. There are trees in there now after 5 years that are 12 and 15 feet tall. Nature brought it all back, being that the deer and livestock couldn't get in."

With cost-share assistance from several Federal and state agencies, Falge also has installed sediment-retention structures. "We've been fortunate with them helping out," says Falge, who adds, with obvious pleasure, "In 1994 there were five salmon I saw here in the stream. Fish and Game wanted me to call if ever I saw any. There were no females, all males. I saw two this year, and I think they were a pair and might have spawned. Now, 2 years in a row, we've seen some come back."

One novel program hires displaced salmon fishermen to work on salmon habitat restoration. The U.S. Department of Commerce is funding the Northwest Emergency Assistance Program, which NRCS and its resource conservation district partners help administer. In four northern California counties–Del Norte, Humboldt, Mendocino, and Sonoma–displaced fishermen are performing salmon habitat needs assessments and restoration on private land in a number of watersheds.

One program participant is Yoon, who serves as the outreach coordinator for the Fishermen's Jobs Program of the Humboldt County Resource Conservation District and works with private landowners. "Some of those [landowners] are large timber companies, and there is an important level of communication about the salmon industry in relation to natural stocks. We are a direct reflection of what happens to an industry if its habitat or resource base isn't taken care of. It could happen to timber or agriculture [as it has happened to fishing]."

Cooperation between fishermen and landowners in the Northcoast Habitat Restoration Program is helped by familiarity. According to Gary Friedrichsen, also a displaced fisherman working in the program, fishing and logging were the two predominant blue-collar job opportunities, "and there was quite a bit of crossover." Bill Matson concurs: "Most of my family worked in the woods. My father did, in between fishing seasons. Most fishermen have done the same, fishing in the winter and working in the woods in the summer."

All participants–landowners, fishermen, scientists, and government officials–recognize the enormity of the challenge. Says Schott, "One problem is that we [NRCS] have tended to work only with farming indicators, while others do water quality, wildlife, etc. We are not yet successfully integrating our monitoring to look at the whole picture. We are just beginning to get people together; and people are just beginning to understand the broader picture. Terms like 'health' are important, but even defining that takes work. Peer acceptance is half the battle of working with different groups." Still, Schott is not overwhelmed. "The cheapest conservation we can get," he says, "comes from working with nature."

Restoration of riparian vegetation was largely a matter of installing exclusionary fencing to control deer and livestock access. The riparian zone was nearly denuded (top) when Falge's project began. Five years later, planted and volunteer trees were well-established (bottom).

Locally Led Conservation: More Than the Sum of Its Parts *continued*

Mississippi: Multiple Conservation Benefits

Lake Washington, a 3,000-acre Mississippi River oxbow lake about 30 miles south of Greenville, was in trouble in the 1980s. Deep trouble. "When it rained three or four inches, the lake would be like chocolate milk," says Ronnie Hudspeth, District Conservationist, NRCS. With 70 percent of the watershed in cropland and high phosphorus levels in the lake, agriculture—and at least one community generating untreated sewage—were seen as the major culprits.

In five years, Lake Washington has come a long way. Best management practices—no-till cultivation, filter strips, and grade-stabilization structures to reduce sediment flow—have been applied by most of the 30 or so farmers on the 20,000-plus acres of cropland. The town of Glen Allan has a sewage system. There's a new bed-and-breakfast on the lakeshore, and two new bait shops.

"When we first got started, people wanted the program, but they weren't really sure they wanted to do the things needed," says NRCS area agronomist Ken Ainsworth. Mark Gilbert of the Mississippi Soil and Water Conservation Commission says that "we learned you need to have some type of meeting and really lay our cards on the table. The one-on-one relationship with that farmer [such as NRCS and the districts have] is the key, because it shows the farmer that the agency cares about what he or she is doing." Numerous state and Federal agencies were involved, many of them offering financial incentives, and the nonprofit Lake Washington Foundation helped individuals with their portion of cost-share money.

One innovative grade-stabilization structure, effective on the very gradual slope of the Delta, is an elevated turn row constructed at the low end of a field. Farmers are accustomed to having a drain pipe at the lower end of a field to drain water off at any season. Now, flashboard risers hold the water in during the winter. This simple structure:

- Lets sediment settle out and remain in the field.
- Keeps nutrients (phosphorus) attached to soil particles rather than running off to adjacent waters.
- Maintains standing water that prevents winter weed growth, reducing the need for tillage and herbicides before spring planting and improving soil moisture for the spring.
- Maintains seasonal wetlands with ample crop residue as prime waterfowl habitat.

The million-dollar effort to clean up Lake Washington has paid dividends to the farmers, area homeowners, and recreational users of the lake. Lessons learned on Lake Washington already are being applied to other oxbow lake cleanups in the Delta area, especially the need for early involvement of all interested parties and for developing partnerships among government agencies at all levels and between agencies and private landowners.

together, the easier it gets. As the agreed-upon actions are implemented, their success or failure can be discussed and compared to what had been expected. New experience fosters better understanding of the land, and new opportunities may appear. Individual landowners and managers can see how their own actions fit with those of other community members. Information, not coercion, becomes the most powerful force helping individuals and communities achieve their goals, and the national conservation vision of a healthy land is furthered by the voluntary approaches that have worked.

Conservation on Farms and Ranches

Because most private land in America is used to produce agricultural commodities, most conservation efforts by NRCS and its state and local partners, including the conservation districts, have been directed to farmers, ranchers, and owners of small woodlots. Although the agency serves an increasing variety of nonagricultural clients with both information services and locally led planning assistance, helping to sustain the Nation's agricultural land remains the highest priority within NRCS.

Most technical assistance provided by NRCS is based on the voluntary development of a conservation farm or ranch plan–a resource assessment of the farm or ranch that allows landowners or managers to determine the opportunities for using the resources under their care and how they may achieve their goals. A successful plan helps the individual landowner achieve his or her business and personal objectives while, at the same time, meet his or her responsibility to care for the land.

Agriculture in America is diverse, ranging from small farms or ranches with limited resources to large, highly sophisticated enterprises. The information, planning, and technical assistance needs of farmers and ranchers are equally diverse, and assistance to each must be tailored accordingly. What remains consistent throughout, however, is the underlying theme for NRCS: To help each landowner achieve a sustainable system that contributes to healthy bottomlines as well as healthy ecosystems, landscapes, and watersheds.

At its best, the conservation farm or ranch planning process strengthens the ability of landowners–and communities–to manage change and even define a positive course of action, rather than simply reacting to challenges as they appear. The future surely involves changes in technology, natural resources, social values, and goals. Landowners and communities seldom believe that they can pursue a particular course of action indefinitely. Instead of a single, rigid plan, they need a basis for reacting adeptly to the changes that affect their operations and their home place. Being close to the land day to day provides the opportunity to observe and adjust to change early on. Good conservation plans facilitate such ongoing adjustment. This is the kind of adaptive management that is the hallmark of successful businesses, communities, and ecosystems.

Larry Lefever / Grant Heilman Photography

Conservation Begins With an Individual's Decision

Iowa: Diversifying Agriculture

Ten years have made a big difference. I don't think we'll see the rip, tear, and gouge we saw in the seventies and eighties. A lot of the young men saw that happen, saw the results, and they are going to manage well, take their profits to the bank and smile. It's a totally different generation. They've seen the low, they've seen the high, and they are smarter for that. Our environmental concerns have changed. Our experts have changed. Farmers have changed. It's a whole new ballgame. There won't be fencerow-to-fencerow planting.

David Van Waus, Farmer,
Colo, Iowa

David Van Waus farms 1,000 acres of corn and soybeans in Story County, Iowa, with his brother-in-law, who raises 1,300 hogs. They own half the land and rent the rest. Van Waus says they have built about 17 miles of terraces in the last 10 years, "by ourselves, with nothing more than tractors and loaders and scrapers and an old three-point plow." The farm is "right at the terminal moraine of the last glacier, so we have all types of soil–some 100 percent sand and some of the best soil in the world. I want to make sure that soil stays on my farm and not down some stream. That top 4 inches is my livelihood."

On his terraced areas, Van Waus says, most soils are very light, so he uses almost no tillage for soybeans, and there are terraces every 240 feet. Van Waus uses all the manure the 1,300 hogs produce, and in a dozen years he has restored some otherwise poor soils to an "extremely fertile" rating. He has also cut his need for commercial fertilizers to nearly none. The manure is knifed into the top 2 inches of soil (where the microbial action is highest) so it is absorbed, with the nutrients kept in place.

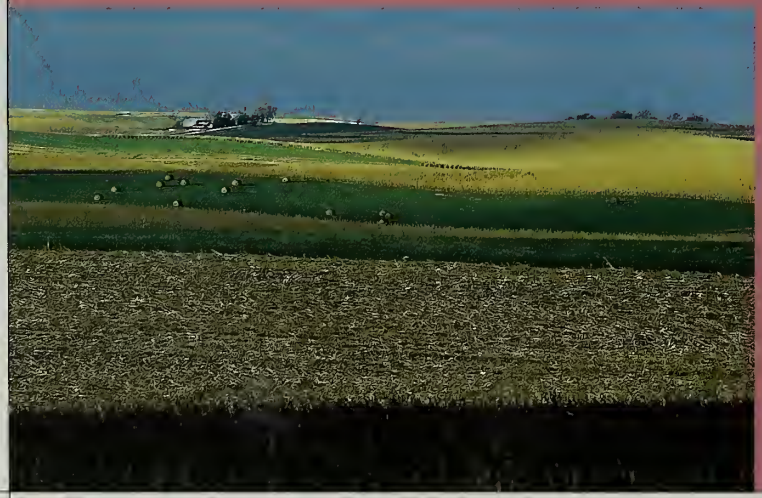
Van Waus strives for diversity, making decisions based on slope, soil condition, and weather. He varies his seed to protect against crop failure; corn rows are often 30 inches apart; soybeans range from 7.5-inch to 30-inch rows. This variation allows for different weather conditions: "Narrow rows demand more water and you can't cultivate, so it becomes a herbicide operation.... I try to grow a diversified crop, both corn and beans. I grow 105-day corn in the bottom areas because of the short growing season on that land; elsewhere, I might grow 118-day corn. That spreads the harvest time, too."

Van Waus tries to plant no more than 20 percent of any one hybrid. "For soybeans, I might stay at 15 percent, depending on where they're planted, whether on sand or on good black soil. On lighter soils, I like to plant full-season corn and beans because they create more trash–vegetation–covering that lighter soil with more residue and working more organic matter back in, too."

The Natural Resources Conservation Service district conservationist in Story County, Tony Maxwell, says Van Waus "looks at wildlife cover, the Conservation Reserve, and tree planting, but yet he makes his money growing corn and soybeans."

Van Waus says, "Some day I'd like to get into the farm management system and make all farmers believers in soil conservation. Profitability is key, but mainly it's the togetherness of folks. People often forget the soil has been here for 10,000 years, and there's no more of it."

Diversification is David van Waus' operating principle–corn, soybeans, and an integrated production system. Van Waus has reduced his commercial fertilizer need to nearly zero, improved soil fertility, and uses tillage suited to soil characteristics.



North Carolina: Protecting the Bog Turtle

Yes, we did try to drain the bog. We used a hand pan; I ran the horses. It took only a few years for the alders to grow back, so we ended up just leaving it. I think it's pretty neat they found the turtle because there's so few of them.

Avis Schuyler, Farm Owner,
Lowgap, North Carolina

What was in the not-quite-drained bog were bog turtles–small, rare turtles that live in freshwater marshes, bogs, and fens ranging from Georgia through North Carolina and Maryland and into New York and Connecticut. What's so exciting about bog

turtles? For one thing, they have been around more than half a million years, since the Pleistocene Epoch, according to Dennis Herman, a herpetologist who has studied the turtles for decades. Nearly 95 percent of their North Carolina habitat has been lost to agriculture and other development, and they are likely to be listed as endangered or threatened in some parts of their habitat. Herman was pretty sure when he saw the Schuylers' bog that it would contain bog turtles, and he was right.

"I was so thrilled we had a new site in Surry County and that I'd trapped a turtle. I just photographed it about 20 times, then I took it to the house and asked [Avis' daughter-in-law] Lisa Schuyler to hold it while I photographed her holding it," says University of North Carolina-Greensboro biologist Ann Somers, who works with Herman.

When the scientists were looking for ways to protect the little 4-inch turtles during mating, egg-laying, and rearing season, local NRCS District Conservationist Dick Everhart suggested that the remaining drainage ditch be plugged and that exclusionary fencing be installed to protect the turtles during nesting and hatching season. The Schuylers agreed. The fencing doesn't cause them any problems, says Avis Schuyler, who co-owns the farm with her son, Trent. "There's plenty of pasture, even with the bog fenced off. The cattle don't need to wade through that bog anyway."

Everhart says the Schuylers have opened their hearts to the little turtle and their farm to the researchers and conservationists who study the bog turtle and its habitat. One day they hosted 50 people, from Maryland to Georgia, who attended a workshop on bog turtle habitat. "One important area we're studying," Everhart says, "is how agriculture and this threatened species can coexist and how to restore and manage habitat in an agricultural setting."

The U.S. Fish and Wildlife Service helped pay for the fencing and will pay for restoration of the bog. The scientists set the traps, installed the electronic bugs on the turtles, and marked their shells with tiny V-shaped notches. But they have enlisted the whole Schuyler family, including Trent and Lisa's children, Miranda and Brannon, to help with record-keeping. They check the turtles three times a week, recording the hour, which trap, and which turtle. "By now," says Lisa, "we know some of these turtles."

According to a number of biologists, the bogs are formed and maintained by beavers, cattle, deer and, possibly, fire. Browsers–perhaps dinosaurs originally, but rabbits, deer, meadow voles, southern bog lemmings, muskrats, cows, and horses today–help the bog turtles by keeping the canopy open, which creates a sunny and rapidly warmed layer above the cool, saturated mud. Herman says also that small herds of grazing cattle or horses prevent waterways from becoming weed-choked–some grazing in the bog helps the turtles. This advice was offered in the action plan Herman prepared for the North Carolina Wildlife Resources Commission.

A critical element in finding, understanding, and protecting bog turtles and their habitat is the interest of landowners. "[Dick Everhart] has had success with some landowners because they regard him as a neighbor and friend and are willing to open up to him," says Herman. "Many of the bog turtle sites are under an acre and impossible to find and worry about, so we have to depend on landowners to come to us. They won't if we regulate. If it's education and incentives, they may open up."

Landowner interest is critical to finding, understanding, and protecting bog turtles and their shrinking habitat.

Texas: A Grass Explosion

What happens on the land is the cumulative effect of individual contributions–across the board.

Rooter Brite, Rancher,
Bowie, Texas

In the Red River country of Texas, near the Oklahoma border, sits Rooter Brite's 3,200-acre ranch, bought by his grandfather in 1929. During the 1930s, the land was horrendous, Brite says, with termites eating the grass below the surface. "People didn't know whether it would ever come back.

Conservation Begins With an Individual's Decision *continued*

Much of the land was poorly managed, mostly as a result of overgrazing. One piece of land I got in the 1980s was so overgrazed, the cattle were leaving a browse line on the trees. One owner had brought in horses, and they raised the browse line even higher. Still, the country is pretty forgiving."

The Brites "stocked to capacity every day, every year, with 15 or 16 cows per 150 acres–until 1969, when we did a single-pasture deferral, a 3-month deferral, and had a grass explosion!" Now, instead of seven pastures, there are 47 or 48. Because there are different classes of cattle (heifers and steers, bulls, replacement heifers, fall-calving cows, etc.), "we need lots of different pastures. We have a much better diversity of grasses, some of which I never even knew existed." Generally, Brite's pastures are about 80 acres, and the time cattle are kept in a given pasture depends upon herd size and type and time of year (whether forage is dormant or not).

Brite says, "My product is grass, sold through cattle." Because the grasses are better, he can keep more animals: Under the old system, Brite grazed one cow on 10 acres, and conditions were rated fair or poor. Now, all pasture is good to excellent, and he can graze 1 animal unit on as few as 5 acres. The individual weight of his cattle is down, but the net salable weight is up.

In 1995, Brite had his best year ever, with 5,000 pounds per acre of native forage, including Indiangrass, switchgrass, little bluestem, and big bluestem. Still, Brite didn't increase his herd to levels that might have been sustained under those conditions, and he believes the grasses are in better shape as a result. With the drought, production in 1996 was down to 1,500 pounds per acre. Even so, "we're baling hay out here right now, when a lot of neighbors don't have any grasses."

Fire is one means of enhancing grass health. "It can be very effective, but it also is very definitely a hazard," says Brite. "Where we have used fire, we've been very successful. I've seen plants I've never seen before; the seeds were there, but dormant, and the fire breaks their dormancy. But there's a lot that goes into deciding whether to have a fire or not. Some pastures don't lend themselves to being burned; others we try to burn every 5 to 7 years."

Gary Conner, the NRCS district conservationist in Montague, Texas, says fire has been used as a tool for 25 or 30 years for rangeland health in Texas. "If you don't burn or at least shred off the grasses really close every so often, you'll lose grass to disease." He adds that there were some wildfires on about 8,000 acres of rangeland in his part of Texas in 1996: "Luckily, they ended up being useful because a lot of oak timber and brush were set back and the canopy thinned, which will let new grasses take hold."

Conner says Brite "gets down to the little things; he gets out there and sees things first hand. Now [in the 1996 drought], he's baling hay, and next year, we'll see the effect of that; he'll learn from it. His place is visible, right on the highway, and some people are beginning to imitate what he's doing." Brite returns the compliment: "I have been opportunistic in taking advantage of things, including the NRCS. You can't imagine the technical competence of NRCS folks. Many people don't take advantage of them, but I do."

Brite explains, "Economic sustainability is essential, but there may be overriding benefits that make something worth doing anyhow. In my operation," he says, "I have to have diversity. In a lot of operations, you're not allowed to have diversity, so people become tunnel-visioned." He notes that some ranchers who run one kind of grass "do much better than I do–if the weather's right and things cooperate. But in bad times, many sure wish they had a more diverse operation like mine. It's like keeping a little money in the bank for when you get sick; we do the same thing with grass management."

Rooter Brite's diverse grazing operation in northern Texas has the resilience and stability to weather good and bad times.

Vermont: Healthy Cows and Happy Farmers

I don't believe that cows got together 50 years ago and said, 'Lets build a barn for us to die in....' The best barn is an electric fence that lets a cow take care of herself–get sun, air, exercise, and comfort. I call it non-barn housing.

John Rutter, Dairy Farmer,
Bridgeport, Vermont

For years, John Rutter was dead set against rotational grazing. The 410 acres he owns and rents in northwestern Vermont has mostly clay soils, and he was convinced grazing would not work. Two things tipped the scale: The drop in milk prices in the early 1990s cost him $100 a day every day for 2 years, and "the work was killing us, and we still weren't making any money for the long run." Rutter had a traditional stanchion barn where, he says, he spent most of his time doing chores: Hitching cows, feeding grain, sweeping up grain, scraping the platform, washing cows, milking. And then repeating the cycle.

In 1993, Rutter experimented by grazing some heifers and dry cows. "We were so impressed that we weren't handling all the materials–manure, feed, etc.–and all we had to do was move fence." That fall, Rutter took a bigger plunge, fencing 160 acres with high-tensile wire, with portable reels between division wires, and installing 20,000 feet of water line.

"It was catastrophic. We had a 35-percent decline in milk production! It is a difficult mental shift for both operators and livestock. After all, the cows were used to being fed and having bedding put underneath them; everything was done for them."

Nevertheless, Rutter stuck to his guns. He made other changes, and now he is a staunch advocate of working with grasses to meet the needs of the cows. Rutter uses an adapted New Zealand-style, flat walk-through barn, with one 8-stall area on each side, which allows a steady stream of cows in for milking. He also has been experimenting with different grasses and using some nitrogen supplements to raise the dry matter and density the cows need. Rutter's neighbor, John Roberts, another grazing pioneer and advocate says, "If you ask the cows to consume over too large an area, when density is too low, they will get bored or tired, and may not eat to full appetite. As the pastures grow better...the cows don't have to spend so much time grazing in order to take in the amount of dry matter they need." Rutter harvests grass silage after the initial grazing. In 1995 he harvested almost all the silage he needed to store for the winter.

Rutter has shifted many of his cows to June breeding (the conception rate appears to be up from about 50 to 75 percent), so calves are born coinciding with the spring flush of grass. In the spring of 1995, 106 of Rutter's dairy herd freshened and by July, 131 cows were milking; only 18 were dry.

Since he began grazing his cows Rutter has noticed many improvements:

- Milk production from his milkers is back up to where it was when he started, if not higher, "because we have healthier cows."
- Milking time is down from 2 hours for 87 cows to as little as 1-1/2 hours for 120 cows.
- His rate for culling cows is 12 percent, down from the 40 percent range most dairy confinement operations suffer.
- In 1995, Rutter's cows required no stored feed between April 25 and October 28, and 100 animals spent the entire winter of 1995-1996 outside. "They're the best animals we've ever raised."

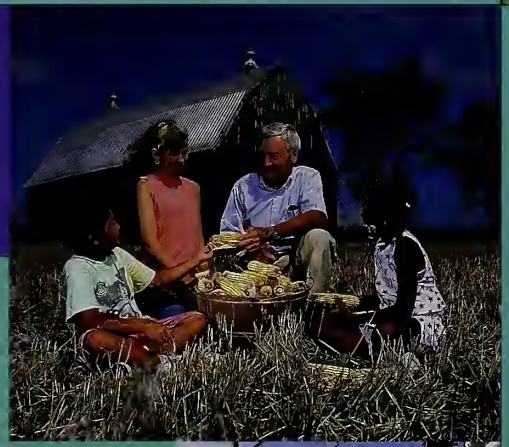
One motivation for Rutter's move to rotational grazing was an approaching need for a new mowing machine, at a cost of more than $16,000. "Instead, we completely changed our harvesting system, spending up to $25,000, and that includes our labor and the expense of minor modifications, adding acres, etc., for the first 2 years, and about $9,000 cost-share money from USDA. That's a small investment, I think, when you compare it to machinery, buildings, and the other costs of taking care of a herd of 200-plus dairy animals, not to mention that the cows are doing the mowing."

Rutter believes this suggests new economic as well as environmental possibilities: "We were killing ourselves and still not making any money–treading water, so to speak," he says, adding that American dairy farmers have spent thousands of dollars on remodeling barns, moving rails, changing space, improving ventilation, etc., supposedly to keep cows clean, dry, and comfy. "We've got to shift capital investment from buildings and machinery to cattle and land because those are the only two things that can produce income."

A Vision for the Next Century

People in cities may forget the soil for as long as a hundred years, but mother nature's memory is long and she will not let them forget indefinitely.
The soil is the mother of man, and if we forget her, life eventually weakens.

— Henry A. Wallace
Secretary of Agriculture, 1936



America's Private Land, A Geography of Hope represents a vision for the 21st century...

- About the importance of private land resources to the well-being of all Americans;
- About the capacity of American farmers and ranchers to produce a bountiful supply of environmental benefits, just as they produce bountiful supplies of food, feed, and fiber crops;
- About the shared responsibility and local action needed to achieve effective land stewardship;
- About how NRCS speaks for the land and encourages land stewardship.

We in NRCS have a vision...

...that farmers, ranchers, and all other private landowners understand they have the care of the land in their hands.

The United States is an expansive, diverse land. Much of that land is privately owned, and most private land is used for agricultural purposes. The health of the American land, therefore, is largely in the hands of those farmers and ranchers who daily make decisions about its use and management.

Our Nation long ago made a commitment to set aside its special places–national parks, forests, and wildlife refuges. We keep that commitment today. A matching commitment is needed to private land, but it is a commitment of a different nature. Instead of a national decision or edict, this must be a shared commitment to stewardship by millions of Americans. A healthy land can only be the sum of many small and local places that are themselves healthy.

The importance of the private land resource to our Nation's economic and environmental well-being was emphasized in the 1996 report of the bipartisan President's Council on Sustainable Development: "Private decisions on managing [private] lands have long determined the quality, vitality, and fate of natural resources and will continue to do so." In other words, the Nation will likely never achieve its goals for conservation and environmental quality if farmers, ranchers, and all other private landowners are not engaged in a cooperative effort to use land according to its capabilities.

NRCS is committed to helping the owners and managers of all private land understand and excel at land stewardship.

We in NRCS have a vision...

...that farms and ranches produce far more than grain and livestock.

America's agricultural production is the envy of the world. Capturing the advantages of fertile soils and favorable climate, our farmers and ranchers produce a safe, affordable supply of food and feed grains, meat and dairy products, fruits and vegetables, and fiber crops. But our Nation's farms and ranches produce far more than these traditional commodities. Well-managed agricultural land also produces healthy soil, clean air and water, wildlife habitat, and pleasing landscapes, all of which are increasingly valued by rural and urban citizens alike.

This growing public interest in private land couples well with the strong and growing desire among landowners to meet their individual and community responsibilities to protect the

natural resources they hold in trust with society. That should make possible, as one farmer recently put it, "the elimination of policy and program barriers to the adoption of sustainable practices and rewarding responsible stewardship."

NRCS is committed to helping the landowners succeed in producing agriculture's environmental commodities, just as those landowners already succeed in producing food and fiber commodities.

We in NRCS have a vision...

...that local action–neighbors working together–is the most promising foundation for effective land stewardship.

For the first time in the history of U.S. agricultural policy, the 1985 farm bill linked eligibility for Federal farm program benefits to land stewardship. The compliance policies–conservation compliance, sodbuster, and swampbuster–in that Act required that farmers practice a measure of soil conservation and wetlands protection in return for commodity price supports, farm loans, crop insurance, and other farm program benefits. Those policies, affirmed in the 1990 and 1996 farm bills and coupled with important cost-sharing programs, produced significant conservation gains over the past decade, but their quasi-regulatory nature also tended to drive individual conservation action toward a lowest common denominator. Some farmers did only what was necessary to comply and nothing more. Conservation achievement thus stopped short of what it could have been and should be if the Nation is to realize its dreams of a sustainable future.

The next increment in land stewardship will come about when rural and urban residents jointly accept the reality that everybody is somebody's neighbor, that shared responsibility is the key. A search for consensus then becomes the foundation for effective land stewardship in communities and watersheds across the country. NRCS and its many partners, particularly state conservation agencies and local conservation districts, along with all the other USDA agencies, are in position to foster the discussion that must occur to achieve this consensus for action–consensus based on sound science, sensible economics, appropriate technology, and current information.

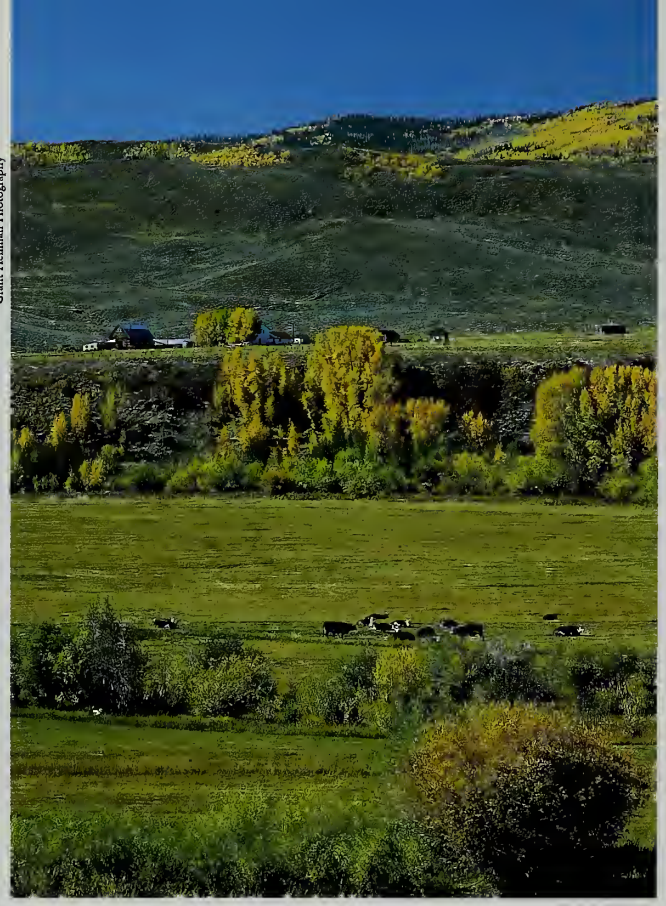
Grant Heilman Photography

The 1996 farm bill put in place a number of new and innovative conservation programs–voluntary, incentive-driven tools–that should prove especially useful in fostering both understanding and action on conservation problems at the local level. NRCS is committed to using both new and existing programs as conservation tools in concert rather than as independent programs. NRCS employees should be conservationists first and foremost, not simply program managers.

We in NRCS have a vision...

...that our agency will speak for the land.

NRCS, formerly the Soil Conservation Service, was born of adversity, a national response to the Dust Bowl catastrophe of the mid-1930s. The agency's first chief, Hugh Hammond Bennett, spoke eloquently for the land when he convinced the Congress that soil erosion was a national menace; that a permanent agency was needed within the Department of Agriculture to call landowners' attention to their land stewardship opportunities and responsibilities; that a nationwide partnership of



Grant Heilman Photography

Federal agencies with local communities was needed to help farmers and ranchers conserve their land.

Today, more than 6 decades later, the land–soil, water, air, plants, and animals–still requires someone to speak for its health and well-being, and that responsibility remains a challenge for NRCS, the Department's lead conservation agency. Indeed, no other Federal agency speaks for the health and fate of America's private land.

NRCS is committed to doing so by working with private landowners and managers to assess the state of their land and protect its values.

We in NRCS have a vision...

...that early in the next millennium our Nation will achieve an added measure of that state of harmony between people and land called conservation.

In a 1939 speech titled "The Farmer as a Conservationist," Aldo Leopold commented: "When the land does well for its owner and the owner does well by his land–when both end up better by reason of their partnership–then we have conservation. When one or the other grows poorer, either in substance, or in character, or in responsiveness to sun, wind, and rain, then we have something else, and it is something we do not like."

Leopold continued: "Let's admit at the outset that harmony between man and land, like harmony between neighbors, is an ideal–and one we shall never attain. Only glib and ignorant men, unable to feel the mighty currents of history, unable to see the incredible complexity of agriculture itself, can promise any early attainment of that ideal. But any man who respects himself and his land can try...."

As we move into the next millennium, our Nation must strive for a state of harmony. We can no longer be satisfied with slowing erosion, water pollution, and other forms of land degradation. Harmony will demand that we set our sights higher–to improve the land upon which our destiny rests by restoring those places that are damaged, by enhancing those places whose condition is merely adequate, and by protecting those areas that remain pristine.

Achieving the ideal may well prove impossible, but helping farmers, ranchers, and others try is the fundamental mission of NRCS. Only then will private land become an integral part of our Nation's geography of hope.

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"...today we understand that narrowly circumscribed areas of natural beauty and protected land alone cannot provide the quality of environment that people need and want. We must also recognize the needs of America's private land and private landowners for us to truly have a geography of hope."

USDA